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THE AMERICAN GAS LIGHT JOURNAL

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

TWENTY-FIFTH ANNUAL MEETING, AMERICAN GAS LIGHT ASSOCIATION.

GENERAL ANNOUNCEMENT.

AMERICAN GAS LIGHT ASSOCIATION,
OFFICE OF THE SECRETARY,
MONTCLAIR, N. J., Sept. 13, 1897.

There will be an annual meeting of the American Gas Light Association held in Old Point Comfort, Va., on October 20, 21 and 22, 1897.

The meeting will be called to order by the President, Mr. Chas. H. Nettleton, of Derby, Conn., at 9:30 o'clock A.M., Wednesday, October 20, in the meeting hall of the Hotel Chamberlin, the headquarters.

The most satisfactory quarters are always obtained by writing in advance to the hotel people, and in so doing a reply should be requested, for which a self-addressed, stamped envelope should be inclosed, as misunderstandings may thereby be averted.

The Chamberlin is conducted on the American plan, and the rates will be as follows: $3 per day for single room without bath; $4 for single room with bath; $3 for each person, in double room without bath; $4 for each person, in double room with bath.

The Hygeia Hotel, directly across the street from the Chamberlin, gives the same rates.

The meeting hall will be the dancing hall of the Hotel Chamberlin; thus the headquarters and the hall will be in the same building.

The Roll Call will be made by means of the door card system. Each member upon entering the hall for the first time will at the door receive a special card upon which he will find his name, address, etc., as it appears on the Secretary's books, and such card should be corrected and given to the doorkeeper. Members in attendance should attend to this very carefully, as these cards are used immediately after the meeting for correcting the annual membership list. Visitors will please hand to the doorkeeper their personal cards.

A blank form of Application for Membership accompanies this circular. More can be obtained of the Secretary.

Remember, all applications must be in the Secretary's hands by Oct. 10, at the very latest, otherwise they will not be acted upon at this meeting.

The list of papers to be read at this meeting is as follows:

"Some Further Experiments on Interior Illumination," by Mr. Alten S. Miller, Long Island City, N. Y.

"Chemical Notes on Purification," by Mr. Henry A. Mather, Brooklyn, N. Y.

"Gas Advertising," by Mr. R. M. Searle, Atlanta, Ga.

"A Report on Burner Stoppages," by Mr. Paul Doty, Long Branch, N. J.

A paper by Mr. K. M. Mitchell, St. Joseph, Mo., giving an account of a method successfully employed by him to obviate trouble from naphthaline.

A paper, the name of the author of which we are not yet at liberty to give.

In addition to the above there will be several topics brought in for discussion by short written introductions.

All questions for the Question Box should be sent in to the Secretary as soon as possible, in order that they may be printed in the next circular before the meeting, thereby insuring their discussion.

During the days of the meeting all announcements will be posted on the Bulletin Board in the meeting room. All members are warned to take notice thereof accordingly.

All members attending the meeting are particularly requested to wear their membership badges in plain sight, thereby greatly aiding the officers and the local committee in their work, by affording a ready means of recognition.

In order that the Year Book containing the report of this meeting may be published and issued to the members immediately after the meeting, notice is hereby given, that if any of the speakers at the meeting desire to correct their remarks in discussions before they are printed, they will be given an opportunity before leaving Old Point, but *not* after. The stenographer will have typewritten copy of the principal discussions prepared at the headquarters between the sessions of the

meetings, and all those who desire to correct their remarks *must* notify the Secretary at the close of the session at which such remarks are made, as all the report will be turned in to the printer immediately after the adjournment of the meeting.

Special rates for transportation have been granted (viz., full fare going and one-third fare returning by the same route), by the several Passenger Associations named, and under the conditions noted.

The Trunk Line Passenger Committee, covering territory west of New England and east of Niagara Falls, Buffalo and Salamanca, N. Y.; Pittsburg, Pa.; Bellaire, Ohio; Wheeling, Parkersburg and Charleston, W. Va.

The New England Passenger Association, covering nearly all of the lines in the New England States.

The Southeastern Passenger Association, covering the territory south and west of the Virginias, and south and east of the Ohio and Mississippi Rivers.

The Central Passenger Committee, covering the following grounds: Bounded on the east, by Pittsburg, Salamanca, Buffalo and Toronto; on the north, by the line of and including points on the Grand Trunk Railway, from Toronto to Port Huron, thence via Lakes Huron and Michigan to the north line of Cook County, Illinois; on the west, by the west line of Cook County and the Illinois and Mississippi Rivers, to Cairo, including Burlington, Keokuk, Quincy, Hannibal and St. Louis; and on the south by the Ohio River, including points on either side of that river.

The Western Passenger Association, covering the territory west of and not including Chicago, Peoria and St. Louis—in other words, the territory west of that of the Central Association—have refused to grant the rate. Members from this territory should buy tickets from starting point to the nearest or most convenient point in the territory of any of the Associations granting the reduced rate, and at such point purchase tickets through to Old Point Comfort and obtain a certificate.

The following extracts from the regulations of the railroads are cited for the information of the members. The special rates are granted subject to these regulations.

First.—The reduction is conditional on there being an attendance at the meeting of not less than 100 persons holding certificates.

Second.—Each person, to obtain the excursion rate, must purchase a first-class ticket (either limited or unlimited) to the place of meeting, for which he will pay regular fare, and upon request the ticket agent will issue a printed certificate of purchase of the standard form. Agents at all important stations are supplied with certificates.

Third.—If through tickets cannot be procured at the starting point, purchase short-trip ticket to the most convenient point where such through tickets can be obtained, and there purchase through to place of meeting, requesting a certificate from the ticket agent at the point where each purchase is made.

Fourth.—Tickets for the return journey will be sold by the ticket agent at the place of meeting at one-third the highest limited fare, only to those holding certificates signed by the ticket agent at point where through ticket to place of meeting was purchased, and countersigned by signature written in ink by the Secretary of the Association, certifying that the holder has been in regular attendance at the meeting.

Fifth.—No reduction of fare will be made on the return passage, if the going ticket is purchased more than three days before the opening date of the meeting; except that when meetings are held at distant points, to which the authorized limit is greater than three days, tickets may be purchased before the meeting in accordance with the limits shown in regular tariffs.

Sixth.—Certificates are not transferable, and return tickets secured upon certificates are not transferable. The transfer of any such is liable to prevent the securing of reduced rates for future meetings.

Seventh.—The certificate of agent at starting point, duly endorsed by Secretary of Association, must be presented to ticket agent at place of meeting, within three days (*Sunday* not reckoned, except by Southern Passenger Association), after adjournment of meeting. The return ticket will be for the line or lines covered by the going ticket.

Eighth.—No refund of fare will be made on account of any person failing to obtain a certificate.

The Old Dominion Steamship Company have also granted a round-trip fare of $10 from New York to Old Point. This includes stateroom and meals both ways.

SPECIAL.

Be sure to obtain a railroad certificate when buying your ticket for Old Point, as the greater the number of certificates handed in the easier it is to get the reduction in rates next year. Apply for ticket and certificate at least 30 minutes before train time. Each person must sign his own certificate at time of purchasing ticket for Old Point. Be sure to have the Secretary endorse your certificate at Old Point as soon as you get there. Apply for return ticket at least 30 minutes before train time, and have your certificate with you. Any person, ladies included, attending the meeting, is entitled to the reduced rate from the territories named. Members will please hand their certificates to the Secretary, or his clerk, upon arrival at place of meeting. If there are 100 members present, holding certificates, each certificate will then be properly endorsed and handed back to owner, before adjournment.

If a sufficient number of subscriptions are obtained there will be a banquet at the Hotel Chamberlin, Thursday evening, October 21, and an excursion on the waters of Hampton Roads and the James River, on Friday, October 22. Tickets admitting member to banquet and, with ladies accompanying him, to the excursion can be had for $5. If you wish to join in these entertainments please sign enclosed card and mail it to the Secretary at once. It will be necessary to have at least 100 subscriptions to make them successful.

ALFRED E. FORSTALL, Secretary.

Extracts from the Constitution.

SEC. 12. Application for Active Membership, or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on.

SEC. 51. No member who owes two years dues shall be entitled to vote, or to participate in the deliberations of the Association, or to receive a copy of the proceedings.

SEC. 52. Any member whose dues shall remain unpaid for a term of three years, may be dropped from the roll of membership by a vote of the Council.

BRIEFLY TOLD.

SOMETHING MORE ABOUT THE COMING MEETING OF THE AMERICAN ASSOCIATION.—All indications now point to a most successful meeting of the American Association next October at Old Point Comfort, for 9 out of every 10 gas men who honor us with a visit declare that the Hotel Chamberlin will house them for the greatest part of the third week of the tenth month. Even at the risk of seeming to advertise the business of the Old Dominion Steamship Company, a thing that we have no desire whatever to do, we must say that by far the greater number of the Eastern contingent propose to reach Old Point through the facilities for sea travel afforded by the Dominion Company's ships. The only reason that this mention is made is to warn the intending travellers, who leave from New York for Old Point, on the ship sailing at 3 P.M. of Monday, October 18th, that their interests will be best served by an early application for berths. The one to address in this respect is Mr. W. L. Gillaudeu, Chief of the Passenger Department, Old Dominion Steamship Company, Pier 26, North river, New York. In further mention about rates for travel, by way of the Dominion Line, and for the sake of clearness, it might do to say that the round trip fare of $10, from New York to Old Point and return, includes transportation, meals and a *berth* in stateroom; the latter apartments being arranged for two travellers. The Western contingent is being taken care of by Mr. F. H. Shelton, of the Chicago branch of the Welsbach Commercial Company, so far as the travel to Old Point from Chicago is concerned. Mr. Shelton suggests that a very available way of going would be on the train leaving the Illinois Central main depot, 12th street and Michigan avenue, 1 P.M., Monday, October 18, the route being through Indianapolis (6:20 P.M.) and Cincinnati (9:10 P.M.), arriving in Old Point 6:30 P.M., Tuesday, the following day. Mr. Shelton's plan includes a special Pullman service of sleeping coach and dining car accommodation, and is altogether a well conceived scheme. He stands ready to furnish any information regarding the trip that may be required by those who propose to make the journey from the Western section of the gas makers' land.

NOTES.—The Town Council of Mishawaka, Ind., which is a flourishing suburb of South Bend, from which place it is but four miles, has had under consideration several offers from parties desirous of securing a franchise to serve the place with gas. Naturally one would think that the South Bend Gas Light Company was the proper source from which the gas supply should be drawn, since that construction would involve merely the building of main and service lines; and the South Bend Company wanted the privilege, but could only agree to furnish the capital with the understanding that a living price for the gas sold might be charged. The outcome of the agitation for a gas works at Mishawaka, however, is this: The Council has granted the right to a man named Hosford, whose phosphitic promise is that he will build a plant, up to a manufacturing and *distributing* capacity of 50,000 cubic feet per day, within one year after the passage of the ordinance. He also agrees that "his Company" will not charge to exceed 75 cents per 1,000 cubic feet for the gas supplied by it. Neither will it; for, unless Hosford is a capitalist with money to lose, the works never will be in working order under the conditions imposed and accepted. The only concern that can supply gas in Mishawaka, with satisfaction to the residents of that Indian named place, and with profit to itself, is the Company over which Mr. Studebaker presides and which has been cleverly directed by Mr. Perkins for "many a year."——The understanding is that the deal for the transfer of the New Haven (Conn.) Gas Light Company's property to other hands is off; and we're glad of it.——The Key City Gas Company, of Dubuque, Iowa, has succeeded in obtaining an extension of its charter until 1919. The main portion of the credit of this continuation should be given to the Company's Secretary.——The new plant of the Southbridge (Mass.) Gas and Electric Company will be completed by December 15th.——The Brooklyn Union Gas Company is perfectly satisfied over its experience with pre payment meters. The use of the measurers is constantly increasing.

Solution of Solids in Gases.

The *Gas World* publishes the following summary of a communication on the above named subject, by Mr. P. Villard, before the French Physical Society:

In 1880 Hannay and Hogarth found that they could dissolve solids, such as bromide and iodide of potassium, in alcohol vapor heated above the critical temperature of the vapor; and in the same year M. Cailletet dissolved liquid carbonic acid in compressed air. These have not been the only experiments made in this direction, but nobody appears to have tried whether, at ordinary temperatures, gases possess the property of dissolving liquids or solids under ordinary circumstances. The property exists, however, and can be readily demonstrated. A solid immersed in a gas may disappear, may diffuse amid the gas, and may do so in quantity sometimes much greater than that which would be necessary to saturate an equal volume originally a vacuum. The following results have been obtained, unless the contrary is stated, at a temperature of 17° C. (62.6° F.):

Oxygen, Air, Hydrogen.—When a liquid such as bromine is dissolved in oxygen gas the gaseous solution is colored. It is enough to put a drop of bromine at the bottom of a narrow glass tube, and to introduce into the upper part of the tube some oxygen, at, say, 200 atmospheres pressure. The bromine vapor which had originally filled the upper part of the tube is at first crowded back towards the drop of bromine, and becomes deeper in color. On inclining the tube this layer of bromine vapor diffuses into the oxygen, and fresh quantities of bromine are dissolved away into the atmosphere of the tube, so that the color becomes far deeper than at first. Diffusion alone will bring about the same result if a sufficient time elapses. If the pressure be lowered the depth of color falls off, and droplets of bromine are deposited, which disappear if the pressure be restored. There is thus a true solution, in the oxygen, of a notable quantity of bromine. At 300 atmospheres the depth of color may be much greater than that of bromine water, and may be the same as with six equally thick layers of bromine vapor saturated in a vacuum. Such high pressures as 300 atmospheres are not necessary; with oxygen the result is distinctly marked at 4 atmospheres, and is very marked at 50 to 100 atmospheres, at which last the color is about three times as deep as that of ordinary saturated bromine vapor. These observations are very easy to make in sealed tubes of suitable sizes. Air acts nearly like oxygen, but somewhat more feebly. Iodine acts similarly in oxygen, but the tubes must be some ¼ inch in diameter, and the pressure must be at least 100 atmospheres. Hydrogen has only a feeble solvent power, and this is only manifest, with bromine, at pressures from 200 to 300 atmospheres.

Formene and Ethylene.—Formene serves very well as a gaseous solvent for chloride of ethyl, for bisulphide of carbon, for alcohol, camphor or paraffine. With this substance it is not necessary to reach high pressures in order to demonstrate a distinct degree of solubility, say, 1 in 100 or 1 in 1,000. Chloride of ethyl will dissolve in five or six times its volume of formene gas under a pressure of 200 atmospheres. If we present more chloride of ethyl than this to the formene, it is the formene which completely dissolves in the chloride. At 17° C. and 200 atmospheres the liquid solution of the gas and the gaseous solution of the liquid have become completely miscible, so that the surface of separation between them disappears when this pressure is attained. With bisulphide of carbon the same disappearance of the bounding surface takes place under 550 atmospheres at ordinary temperatures; 250 atmospheres at 150° C. (302° F.). Iodine dissolves easily in formene vapor, and at 300 atmospheres renders it very dark, even in thicknesses of 0.08 inch. Visible quantities of camphor and of paraffine are also dissolved, and are deposited in fine crystals or rods when the pressure is relaxed.

Ethylene also shows the same thing. Under 300 atmospheres, at 17° C., it dissolves enough iodine to make it a deep violet in layers of 0.08 inch thick; and in an hour or two iodide of ethylene is formed, of which the greater part remains in solution in the ethylene, but is precipitated in a crystalline form by lowering the pressure of the gas. Above 150 atmospheres ethylene dissolves paraffine abundantly; and on lowering the pressure the paraffine assumes the solid form and frosts the inside of the glass. Stearic acid also dissolves in the same way, but less easily than paraffine. The behavior of camphor is peculiar. At low pressures it assumes the gaseous form, but at 150 atmospheres the portion of the camphor which has not been taken up by the gas is liquefied, and increases in volume. If the pressure is raised further, at above 150 atmospheres the liquefied camphor dissolves in the gas above it or mixes thoroughly with it. On reducing the pressure those phenomena are presented in the reverse order. Compressed carbonic acid gas, whether there be liquid carbonic acid in contact with it or not, dissolves iodine, and becomes violet. Generally, the dissolving power of liquefiable gases presents no feature of importance; thus nitrogen protoxide at 20 atmospheres and at 17° C. dissolves bromine in the same way as oxygen will do at 40 atmospheres.

Critical Pressure.—In these phenomena of solution we find that for each particular temperature there is a "critical pressure" at which the gaseous solution and the substance acted upon merge into one another. If chloride of ethyl, which is a liquid, be acted upon by compressed gaseous formene at about 17° C., at 200 atmospheres pressure the bounding surface of the liquid disappears. The phenomena are very similar to the blending of liquid carbonic acid into compressed carbonic acid gas at the critical temperature and pressure, but are better marked. If the tube be kept perfectly quiet, and maintained at a definite temperature, and if chloride of ethyl be first introduced and the formene then added, so as to get up the required pressure, the level of the liquid first remains approximately fixed as the pressure rises, and then, when the critical pressure is reached, the meniscus or sharp curved surface of the liquid disappears and a zone of transition takes its place; but it is some time—even whole days—before the contents of the tube become uniform. If, on the other hand, the tube is shaken, the level of the surface of the liquid changes considerably, and may even travel up or down as far as the end of the tube before the critical pressure is reached. The tube must, therefore, be made to contain a certain proper proportion of the liquid before the change which takes place at the critical pressure can be observed. As the critical pressure is being approached the liquid and the gas become optically more and more similar; and when it is reached they merge into one another, and cannot be distinguished. The change of level is caused by the joint action of (1) evaporation of the liquid into the gaseous solvent, and (2) absorption of the gas by the liquid. The liquid expands as it dissolves more and more of the gas, and at the same time the gas becomes heavier as it becomes more and more compressed and more and more charged with the liquid. This goes on until the two conditions meet; and at the critical pressure the two portions become identical in composition. If the liquid in the tube is insufficient, it will all be taken up by the gas, and will disappear; if it is too much, it will take up all the gas, and will come to fill the tube before the critical pressure is reached; the quantity of it must stand within certain limits, in order to enable a portion of liquid solution of the gas and a portion of gaseous solution of the liquid both to be present as the critical pressure is being approached. When the contents of the tube are carefully kept quiet as the pressure continues to rise, the process of diffusion is too slow to enable the two portions to become identical, except near their junction; so that we have merely a zone of transition and a blurred boundary surface between the liquid and the gas, while the action does not affect the bulk of the liquid or of the gas, and the level of the liquid alters very little; and even beyond the critical pressure we must allow a considerable time to elapse before diffusion can produce that uniformity which will ultimately result, but which is insured at once by shaking the tube.

When the two layers are brought nearly to this critical pressure, and the pressure is suddenly released, there is a simultaneous boiling of the gas out of the lower layer and a rain of the dissolved liquid out of the gaseous layer.

For a given pair of substances this critical pressure varies with the temperature. Beyond a certain limit of temperature it falls as the temperature rises, until it reaches a certain limit, which is the same as the ordinary critical pressure of the liquid itself. When this condition is reached the gas has no solvent action upon the liquid.

Dissociation.—The above facts serve to explain some phenomena of dissociation. When a substance is dissociated by heat so that one of the products is a permanent gas, the pressure goes on increasing as the temperature rises, so that ultimately a pressure is reached which stops the reaction. If, on the other hand, the gaseous product is liquefiable, there is a difficulty experienced in getting up a pressure sufficient to stop the reaction, for the gas is liquefied before this pressure is attained. But if we add an inert gas, this liquefaction is prevented, for the liquefiable gas is dissolved in the inert gas, to a greater or less extent. (The result is quite analogous when we have such a dissociation as that of sulphate of mercury in water). The consequence of preventing the liquefaction in this way is that a higher temperature may be applied without causing the substance to decompose with the same freedom. Take, for example, the hydrate of bromine, which decomposes so as to reach, in a vacuum, a state of chemical equilibrium at 6° C.; if air be added, the bromine liberated is dissolved by it, and at ordinary atmospheric pressures the condition of chemical equilibrium is only reached at from 6.8° C. to 7° C., while at a pressere of 200 atmospheres this tem-

perature stands as high at 20° C. Hydrogen is less effective, for it has less solvent power over bromine ; and at 200 atmospheres it only brings this temperature of dissociation equilibrium up to 9° C. Similar results are obtained with the hydrates of chloride of ethyl, of iodide of methyl, of chloride of methylene, of bisulphide of carbon, etc. It is to be noted that the solubility of bromine in air at the ordinary pressure is inappreciable to the eye, and yet it is sufficient to raise this temperature of dissociation equilibrium about 1° C., even at ordinary atmospheric pressures.

M. Ch. Ed. Guillaume remarks that the above also serves to explain the fall-off in the lighting power of an electric arc lamp when the pressure of the air around it is increased ; for if we assume that the carbon from the positive crater is in a state of solution in the air, as we increase the pressure we increase the solubility ; and then, for a given quantity of carbon taken off the positive crater, the temperature will stand at a lower level.

Some Tests on the Variation of the Constants of Electricity Supply Meters, with Temperature and with Current.

[Read by Mr. G. W. Donald Ricks, A.C.G.I., before the Toronto Meeting of the British Association.]

The general object of the tests was to afford a means of studying the behavior of direct current electricity supply meters with regard to variations in the accuracy of their indications under varying conditions of temperature, current and potential difference.

Some of the more important meters were put through a series of tests which aimed at ascertaining. 1. How the accuracy of the meter depended upon the current at various constant temperatures, all other conditions being maintained constant. 2. How its accuracy depended on the potential difference at constant current and temperature.

The first of these tests was carried out at three different temperatures —namely, about 2° C., 18° C. and 40° C., which may be fairly taken as the extreme and mean ordinary working temperatures. From the results of this test the effect of change of temperature at constant potential difference and current was ascertained. The second test is, of course, only applicable to energy meters. It was made at the maximum current and at atmospheric temperature, the pressure being varied from about 10 per cent. below to 10 per cent. above the normal value.

The tests were carried out at the City and Guilds Central Technical College upon each of the following meters, obtained direct from the makers, and not opened or in any way altered before testing : Elihu Thomson, Schuckert, Ferranti, Perry, Chamberlain and Hookham.

These, it will be seen, fairly represent the principal types of direct current meters now in general use in England.

A very fair idea of the relative advantages and disadvantages of each meter may be obtained from the accompanying Table I. :

Table I.

Meter.	Maximum Current in Amperes.	Normal Pressure in Volts.	Resistance in Ohms. Main Circuit. At 1 Ampere.	Resistance in Ohms. Main Circuit. At Maximum Current.	Resistance in Ohms. Shunt Circuit.	Power Wasted at Max. Current. Main Circuit.	Power Wasted at Max. Current. Shunt Circuit.	Power Wasted at Max. Current. Total Watts.	Fall of Potential in Series Circuit at Maximum Current.	Starting Current per Cent. of Maximum.	Temperature Coefficient.
Elihu Thomson	10	100	0.0948	0.0958	3101	9.58	3.22	12.8	0.958	1.4	—0.32
Schuckert	15	110	0.0420	0.0438	2585	9.9	4.77	14.67	0 66	1 93	—0.13
Ferranti	25	....	0.0154	0.0131	....	8 19	....	8.19	0 327	0.8	+0.07
Perry	30	....	0.00327	0.00331	....	1.32	....	1.32	0.066	1 25	—0.47
Chamberlain & Hookham	25	....	0.0137	0.0157	....	9.8	....	9.8	0.392	0.8	—0.22

The first two columns simply show the current, and in the case of energy meters the pressure for which each meter is intended. The resistance of the main circuit given in the next two columns was measured by means of a standard ammeter and a standard reflecting voltmeter, and the resistance of the shunt circuits on a Wheatstone bridge.

Considering first the Elihu Thomson meter, it will be noticed that its resistance is comparatively large, the fall of potential at 10 amperes amounting to nearly 0.96 volt. The temperature coefficient is also comparatively large, and the starting current 1.4 per cent. of the maximum current, which is, perhaps, not excessive for this class of meter, especially when used on alternate current circuits.

The Schuckert has an advantage over the Thomson meter in that its resistance is very much less, reducing the fall of pressure and wasted power, but on the other hand its starting current is higher, being 1.93 per cent. of the maximum. Its temperature coefficient is also much less than that of the Thomson meter.

Turning now to the ampere hour meters, the first point to be noticed is that their resistances are very much lower than is the case with the energy meters. Not only do they save the three or four watts absorbed in the pressure circuit, but the watts wasted in the main circuit appear to be much less.

The Ferranti meter starts with a very small current, 0.8 per cent. of the maximum, and has an extremely low temperature coefficient.

The Chamberlain and Hookham meter has an equally low starting current and a moderate temperature coefficient, its resistance being rather higher than that of the Ferranti for the same maximum current.

The Perry meter has an extremely small resistance, causing a fall of pressure of less than a tenth of a volt at a maximum current and absorbing only 1.32 watts. In this respect it is far in advance of all the others, but it has the disadvantages of comparatively high starting current and temperature coefficient.

Adoption of a New Lamp for Incandescent Gas Burners in the Public Lighting of Liverpool.

The following is the text of the report (reprinted from the *Journal of Gas Lighting*), submitted by Mr. C. R. Bellamy, Superintendent of Street Lighting for Liverpool, England, to the Liverpool City Council. The report relates to the experiments carried out for some time on a large scale in Liverpool with incandescent gas burners for street illumination :

The incandescent gas burner (Welsbach patent) came into practical use in 1893 ; and was first adopted in Liverpool for street lighting purposes in May, 1894. The advantage offered by this form of burner was a much higher light efficiency, developing in Liverpool a maximum of 20 candles per foot of gas, as compared with 4 candles with the best type of ordinary flat-flame burner. For comparative purposes, it is necessary to base calculations on a much lower efficiency, as in practice it is found that there is a continuous depreciation of the mantle during use. A large number of tests of new mantles, and those that have been in use for varying periods between one and nine months, show that an average efficiency of 13 candles throughout the useful light of the mantle may be assumed. On this calculation, the incandescent gas burner is shown to yield more than three times the light of the ordinary flat flame burner consuming the same amount of gas.

The first experiment on a large scale in Liverpool was carried out in Lime street, where 154 burners were fixed in the then existing high power lamps, in clusters of two or three, in place of flat flame burners. The gas consumption under the flat flame system was exceedingly high —amounting to 4,291,319 feet per annum, which was at once reduced by the adoption of the incandescent gas burners to 940,041 feet, effecting a saving in the gas charge of $2,513.45 per annum.

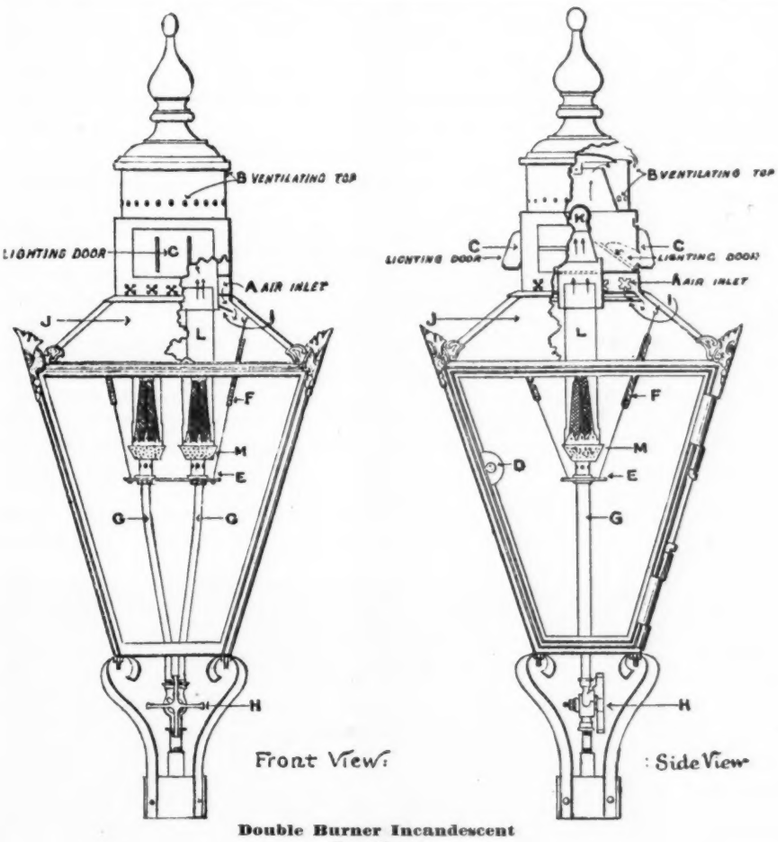
The disadvantages attending the use of the incandescent gas burner were principally the difficulty in lighting the burner surrounded by a glass chimney, and the fragility of the mantle, rendering frequent replacements necessary. Owing to the unsuitable construction of the Lime street lamps, it was found, as the result of a year's working, that each burner required on an average the following renewals :

Mantles	13
Chimneys	12
Mantle rods	3

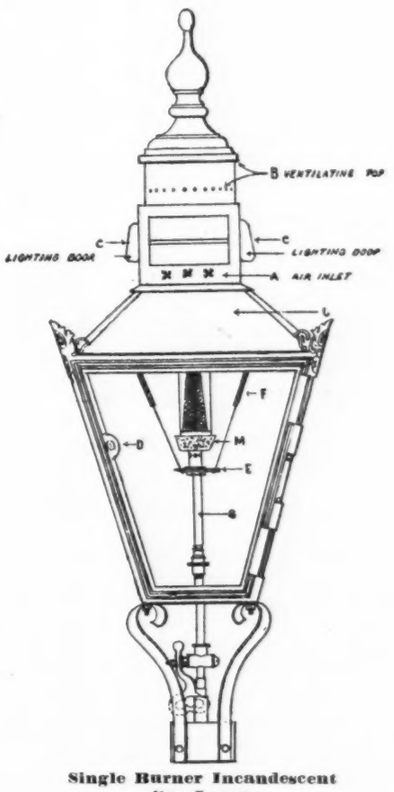
Amounting in the aggregate, under the then existing prices, to an annual maintenance charge (including a labor item of 35 cents) of $5.06 per burner.

At that time, the most approved method of lighting was by means of a small bye pass or pilot light, provided within the mantle, which remained lighted during the day, for the purpose of igniting the main supply when turned on by the lamplighter at lighting time. It was found, however, in practice, that these pilot lights were unreliable, a proportion of them becoming extinguished during the day—necessitating a special visit of the lamplighter with a ladder after completing the lighting of his district. Added to this was the deterioration of the mantle due to its use, and the cost of the maintenance of the pilot light; the consumption of gas for the purpose being assessed at 0.25 foot per hour, which amounted to an annual consumption of 1,428 cubic feet, involving an addition to the ordinary lighting charge (with gas at 75 cents per 1,000 feet) of $1.06 per burner per annum.

It was therefore found that, under the closest supervision, the renewals and the additional gas for the pilot light involved an aggregate an-



Double Burner Incandescent Gas Lamp.



Single Burner Incandescent Gas Lamp.

nual charge of $6.12 per burner in excess of the ordinary gas burner which was regarded as unsatisfactory.

Efforts were made to reduce this charge, by abolishing the pilot light and lighting the burner by means of a match and ladder. This was found both costly and inconvenient to the public; and further efforts were made to obtain a lamp in which the burner should be used under the best conditions in respect of ventilation, suitability of position, freedom from vibration, and capable of being lighted by the lamplighter in the same way as the ordinary lamp—viz., by means of a torch and pole.

This resulted in the production of the lamp at present in use, and which is shown on the accompanying drawing. *A* is the air inlet, and *B* the ventilating top. *C* are lighting doors; two being provided, fixed in line with the street, to enable the lamplighter to use the door on the side of the lamp opposite to the direction of the wind. The lamp is lighted by thrusting the torch through the lighting door into the box *K*, where the gas, escaping through the chimney *L*, is lighted. *D* is the cleaning door, with lock. As all the products of combustion are carried by means of the chimneys into the lighting box beyond the glazed portion of the lantern, internal cleaning is only necessary at long intervals. Frequent access is not, therefore, required; and the locking of the door prevents interference with the burners. *E* is the suspension platform. *F* are suspension wires and springs. The springs permit of the platform being depressed, which draws the glass chimney out of the copper chimney and permits of the renewal of the parts without disconnecting the platform *E*. *G* are flexible tubes. *H* is a three-way cock, for the double burner lamp. This is so arranged that either or both of the burners may be used; the practice being to light both until midnight, and, with weekly alternations, one of the burners remains lighted until daybreak. *I* is an enameled steel reflector, acting as a baffle plate to the fresh air supply. *J* are opal glass reflectors. *M* is a wire gauze cup to prevent back lighting. The lamp is lighted over the chimney, in the ordinary way, by means of a torch, with the same facility as an ordinary flat flame burner lamp, and with no greater expenditure of time.

It has been stated at various times that the lighting of the burner over the chimney is detrimental to the mantle; but it has been found in Liverpool to be a distinctly beneficial process, as it does away with a continuous passage of air, laden with the products of combustion arising from a luminous flame and the dust of the atmosphere, due to the use of the bye-pass jet within the mantle during the hours of daylight. As a subsequent table shows that a number of mantles have been in use under this system for nine months, or 2,341 hours, with an average efficiency at the end of this time of 10.39 candles per foot of gas, it must be admitted that this system of lighting is beneficial to the mantle, and is the most satisfactory yet adopted.

There are 1,783 burners now in use, out of a total of 2,051 ordered by the Committee to date. In 901 of these lamps, 882 are fitted with double and 19 with single burners; the total work ordered to date dealing with 19 miles of streets. A large number have been subjected to most severe tests, extending through the stormy autumn and spring of 1896–97, in positions embracing many of the streets of maximum heavy vehicular traffic and exposure.

It was thought desirable not to allow the lamplighters to undertake the renewals of the mantles, etc.; and an inspector has been appointed, whose duty it is to visit each of the lamps two or three times a week, under a carefully organized route table, during the lighting hours, and to report daily upon the condition of the lamps and as to requisite renewals, which are ultimately carried out by an experienced and independent fitter. This special supervision and treatment, though most effective, add 50 cents per annum to the maintenance charge per burner; and it is hoped that ultimately it will be found practicable to transfer the work to the ordinary lamplighting staff under a greatly reduced charge.

A carefully prepared register has been kept of each burner, showing the date of fixing, and all subsequent renewals, etc. An analysis of this has been made, which shows that a considerable number of mantles have been in use for over six months, and others for seven, eight or nine months without requiring renewal. A number of these have been brought in for photometric testing, with the results shown in the table. (See Table of Illuminating Power Tests, following page.)

As already pointed out, the mantles in use for nine months show an average lamp hour life to date of 2,341, while the average useful life of the mantle over the whole of the system is found to be 1,137 lamp hours. The average annual renewals per burner have worked out as follows:

Mantles	2.60
Chimneys	2.30
Mantle rods	0.23

At a cost of 97 cents, to which is to be added the cost of supervision and

Illuminating Power Tests of Incandescent Gas Mantles, Removed from District.

Situation.	Date of Fixing.	Date of Test.	Months in Use.	Lamp Hours.	* Candle Power.
				H. M.	
Sir Thomas street.....	9-10-96	15-7-97	9	2,378 57	34.03
Stanley street.....	"	16-7-97	9	2,383 37	30.05
Ditto	"	"	9	2,383 37	25.18
North John street.....	14-10-96	15-7-97	9	2,331 34	27.54
Ditto	"	"	9	2,331 34	41.02
Cook street.....	"	"	9	2,331 34	28.47
Exchange street East..	"	"	9	2,331 34	39.07
Ditto	"	"	9	2,331 34	27.56
Ditto	15-10-96	"	9	2,322 6	32.59
Chapel street.....	16-10-96	"	9	2,312 37	30.46
Ditto	"	"	9	2,312 37	27.17
South Castle street....	29-10-96	7-7-97	8	2,144 44	27.88
Chapel street.....	5-11-96	15-7-97	8	2,110 3	38.01
Harper street.....	16-12-96	7-7-97	7	1,609 43	26.43
Ditto	"	"	7	1,609 43	26.19
Ditto	17-12-96	"	7	1,598 1	34.41
South John street.....	24-12-96	"	6	1,516 3	32.03
Ditto	30-12-96	"	6	1,446 3	37.28
Ditto	31-12-96	"	6	1,434 23	34.80
Ditto	"	"	6	1,434 23	30.36

* Consumption fixed by governor at 3 cubic feet per hour.

labor at 50 cents per burner, making a gross annual charge of $1.47 in excess of the ordinary flat flame burner, as compared with $6.06 under the first system, being a reduction of 75 per cent. in the maintenance charge of the incandescent gas burner due to the adoption of the new lamp.

For the purpose of enabling the Committee to arrive at an estimate of the relative value of the present incandescent gas lamp as compared with the ordinary flat flame burner lamp, the following table of the first cost and annual maintenance has been prepared :

Description of Lamp.	Gas Charge at 62 Cents per 1,000 Cubic Ft. Per Annum.	Average Illuminat. Power. Candles.	First Cost of Lamp and Fixing.	Total Annual Charge.
Double burner incandescent lamp.....	$10.97	80	$11.85	$18.18
Single burner incandescent lamp.....	7.06	40	9.33	12.79
Ordinary flat flame burner.....	7.31	16	5.27	11.56

The above figures, which are useful for comparative purposes, do not supply the most important information—viz., the cost of fixing the new lamps in lieu of the existing flat flame burner lamps, which is as follows :

Double burner lamps.....	$7.87
Single burner lamps.....	5.35

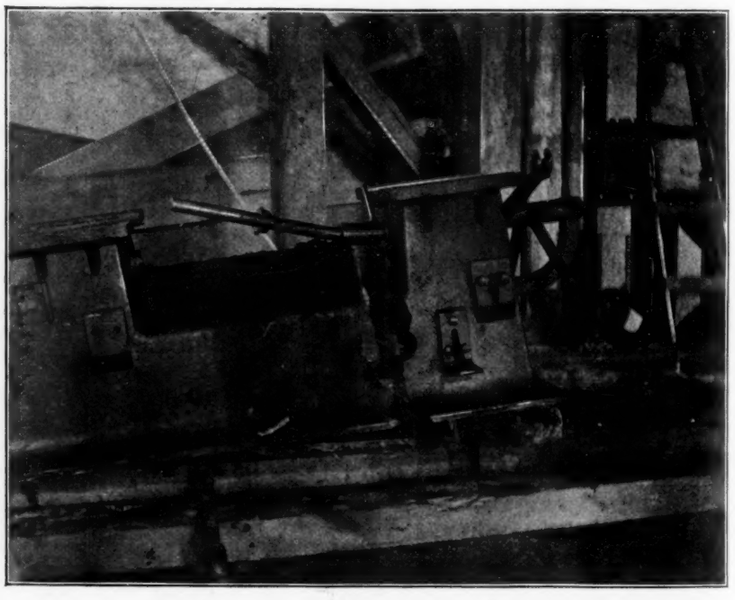
These prices are lower than the first cost in the statement above, owing to the credit allowed for the ordinary lamp superseded, and which is taken into stock at 20 per cent. under first cost, for re-fixing in other parts of the city. This has rendered the further purchase of ordinary lamps unnecessary.

Though the experience of the past three years has conclusively proved that the incandescent gas burner cannot be used with complete success in the ordinary form of lantern, and, therefore, a somewhat heavy first expenditure is involved in the adoption of the system, the subsequent advantages are so great that a general extension appears irresistible.

A Lesson Afforded by the Failure of a Gas Engine.

Mr. E. C. Hathaway, Superintendent of the Capital Gas and Electric Light Company, of Frankfort, Ky., forwards us two photographs, from which the accompanying illustrations were made. The pictures rather graphically show the results of a "peculiar accident" that overcame a 55-horse power gas engine, of the Hicks tandem cylinder type, which had been furnishing power in a flouring mill at Frankfort.

Mr. Hathaway says, in speaking of the breakdown : "Comment is unnecessary, for the occurrence shows the utter futility of trying to design a gas engine without any adequate knowledge, on the part of the designer, of the stresses to which the motor is likely to be subjected, and how to provide for them. The engine failed from inherent weakness. Any standard single cylinder engine, to develop 55-horse power, would contain about 6,000 pounds more material than the one the wreck of which is shown in the inclosed photographs."



The Clarke Apparatus for Heating Water.

On June 15th, last, U. S. Letters Patent (No. 584,326) were granted to Mr. William C. Clarke (the inventor subsequently assigned the rights to the Gilbert & Barker Manufacturing Company, of Massachusetts), of this city, for new and useful improvements in apparatus for heating water. Using the words of the specification :

My invention relates particularly to a device for heating water by gas in which a valve in a gas pipe leading to heating burners shall be automatically opened whenever water is drawn from the vessel heated by such burners and closed when water ceases to be drawn. This may be accomplished by utilizing the hydraulic pressure in the water pipe leading to the heating vessel. All efforts to this end heretofore have been in the direction of making a purely automatic non-adjustable device. I have found, however, that owing to the great difference in water and gas pressures in different locations it is essential to the practical use of

Fig. 1

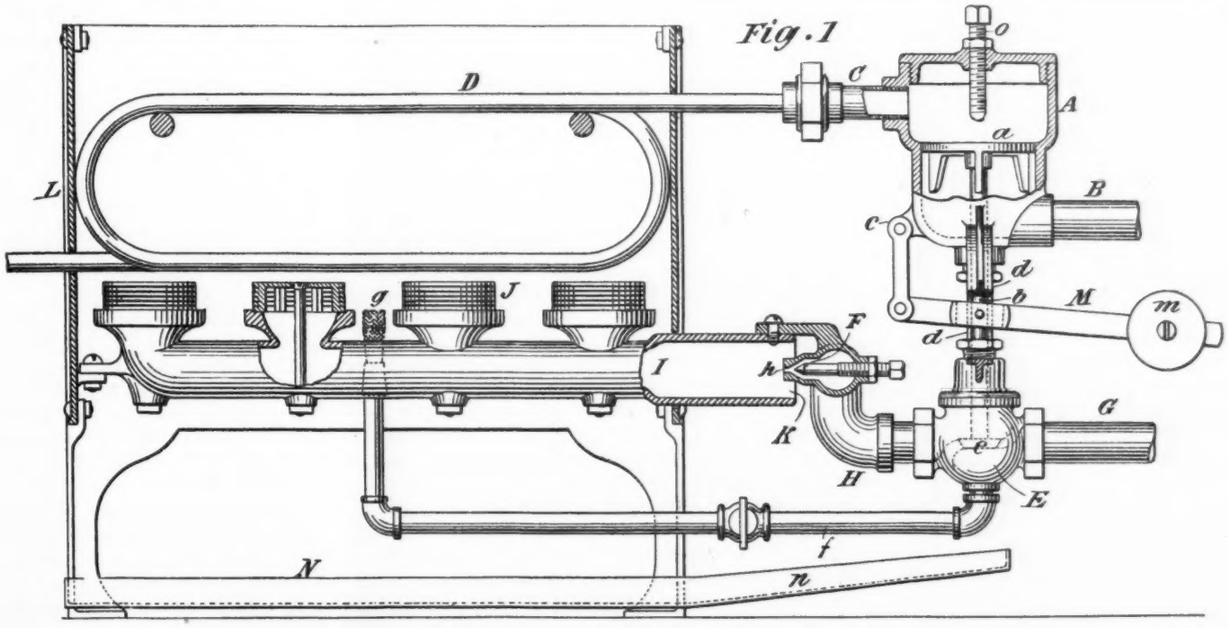


Fig. 2

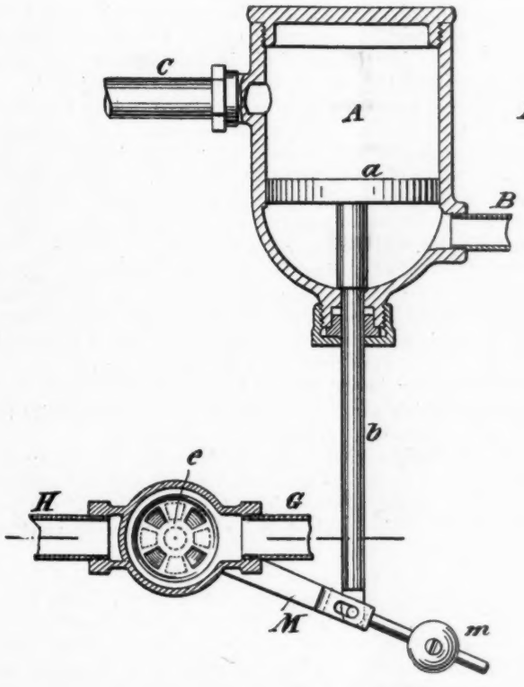
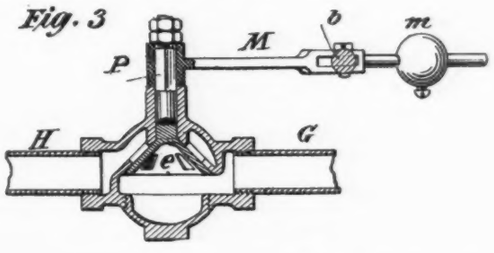


Fig. 3



such a device that it shall be not only automatic in its operation, but that it may be accurately adjusted to meet the different conditions to which different heaters will be subjected. For example, a heater so constructed that its gas valve will be properly opened and shut and a proper supply of gas will be carried to the burners when it is located in the basement of a building may, if located on an upper floor of the same building, either fail to open its gas valve at all, or if the gas valve is opened such a volume of gas may be carried to the burners as will produce a smoky flame. It is essential also, in order to prevent smoking at the burners, that a percentage of atmospheric air proportioned to the quality of the gas shall be mixed therewith, and such apparatus must, therefore, be able to conform not only to different gas and water pressures, but also to the different qualities of gas found in different locations. These requirements have heretofore not been recognized, or their importance has been disregarded in all former attempts to construct apparatus of this class, so that, notwithstanding the evident desirability of such a device, it has not heretofore come into practical use. To meet these conditions and provide a form of apparatus which, while adaptable for use in connection with different qualities of gas and different gas and water pressures shall at the same time be automatic in its operation and shall be simple and durable in its construction, is the object of my invention.

To this end I provide two chambers having independent walls and separated by an air space, one of which is connected with a feed-water pipe, which supplies a water heating vessel, and the other is connected with a gas pipe, which supplies gas to burners employed to heat such vessel.

In the chamber connected with the water pipe is a piston head adapted to be raised by the hydraulic pressure when water is flowing through the pipe, and to this is attached a rod or spindle, which projects through the wall of the chamber and operates a valve in the gas pipe.

The separation of the chambers prevents any water that may escape around the spindle from entering the gas pipe, and enables me to attach to the spindle a pivoted lever, carrying a weight which is adjustable thereon, which operates to bring down the piston head and spindle and close the gas valve when water is not flowing in the water pipe. By this means I am enabled to pack the spindle which projects through the wall of the water valve chamber as tightly as may be required to prevent the escape of water in view of the pressure at the point where the device is located, and at the same time to adjust the force operating to close the gas valve so that it will overcome the friction of the packing and close the valve when water is not flowing, and will, on the other hand, permit the water pressure to operate to open the gas valve when water is flowing through the pipe.

In the gas pipe, between the automatic valve and the burners, I provide a manually adjustable valve and an air induction port whereby air is drawn into the pipe and mingled with the gas and the proportions of air and gas adjusted with reference to the quality of gas used, so as to regulate the quality of the flame at the burners and prevent smoking, whatever may be the pressure in the gas pipe.

The invention will be best understood by reference to the accompanying drawings, in which—

Figure 1 shows a vertical elevation, partly in section, of the apparatus; and Figs. 2 and 3 show the details of a modified form of valve in the gas pipe.

Referring to Fig. 1 of the drawings, *A* indicates a chamber connected with a supply water pipe *B*. In the chamber *A*, above the point of entrance thereto of the water pipe *B*, is located a valve disk or piston

head *a*, and from a point in the chamber *A* above the piston head *a* a pipe *C* leads to a heater coil *D*, whence it passes to a hot water cock or by branch pipes to the various hot water cocks in a building. These cocks, which are the usual hot water cocks located at any convenient points of consumption, are not shown in the drawings, not being necessary to an understanding of the operation of the apparatus. Above the piston head *a* the chamber *A* is, as shown in Fig. 1, somewhat enlarged, so as to permit water from the pipe *B* when the piston head is raised to pass around it and so on to the pipe *C* and heater coil *D*.

Below the chamber *A*, and separated therefrom by an open space, is a valve chamber *E*, connected with a gas pipe *G*. To the piston head *a* is attached a spindle *b*, which extends downward through the wall of the chamber *A* and into the valve chamber *E*, where a valve disk carried upon the spindle *b*, or the lower end of the spindle itself, is seated to form a gas valve *e*.

To the spindle *b* is attached a jointed arm or lever *M*, pivoted at *c* to a projection on the shell of the chamber *A*, and carrying an adjustable weight *m*, which serves to draw down the spindle *b* and close the valve *e* when water is not flowing through the pipe *B*. The chamber *A* may, if desired, be provided with supporting legs *d d*, resting upon the valve chamber *E* or a part thereof. From the valve chamber *E* leads a pipe *H*, forming a continuation of the pipe *G*, and provided with a manually adjustable valve *F* and a nozzle *h*, through which the gas is discharged into the pipe *I*, to which are connected the burners *J* under the heater coil *D*. The end of the pipe *I* into which projects the nozzle *h* of the pipe *F* is open, forming an induction air port *K*, through which air is drawn into the pipe *I* and mixed with the gas.

While other forms of valve may be employed, the valve *F* is preferably a needle valve, as shown in the drawings, since with this form of valve the jet of gas acts most effectively as a piston to draw the air through the port *K*.

From a point in the valve chamber *E* back of the valve *e* a small gas pipe *f*, leads to a pilot burner *g*, located contiguous to one of the burners *J*. The burners *J* and the heater coil *D* are located within a case *L*, beneath which is preferably placed a sink *N* to receive any water of condensation from the burners, which may be provided with a trough arm *n*, projecting out under the water valve, into which any leakage from the water valve will fall and be conducted into the sink *N*.

The heating vessel employed must bear such a relation to the inlet and outlet water pipes that the water cannot be drawn therefrom more rapidly than it is admitted thereto, so that there shall be no break in the column of water from the supply water pipe to the point of consumption. It is essential also that the heater shall admit of the rapid heating of the water, which must be raised to the required temperature during its passage therethrough. I find that both these objects are best accomplished by using as the heating vessel simply a coil of pipe or closed circuitous passage of a capacity not less than that of the outlet or draw-off pipe. Such a heater will be always full of water, so that the water will be under constant pressure from the point of supply to the point of discharge, thus insuring the prompt closing of the gas valve when water ceases to be drawn, and at the same time the water is most effectively heated by reason of the comparatively long time during which any given portion of it is exposed on all sides and in a small stream to the heat of the burners while passing through the heater.

In setting the apparatus the spindle *b* is packed with sufficient tightness to prevent the water from being forced out around the spindle under the pressure to which the apparatus will be subjected, and the weight *m* is adjusted upon the arm or lever *M* to correspond with the water pressure in the pipe *B* and the friction of the packing around the spindle, so that the valve *e* will be properly opened and shut, and the valve *F* is adjusted with reference to the gas pressure and the quality of gas at the point of location of the heater, so that when the valve *e* is opened a mixture of gas and air of proper proportions and in proper quantity will be delivered at the burners.

When water is drawn from a cock connected with the heater coil *D*, the pressure of water in the pipe *B* will lift the piston head *a*, and the water will flow on past the piston head to the heater coil. By the movement of the piston head *a* the spindle *b* is lifted and the valve *e* opened, and the gas passes on through the pipe *H* and nozzle *h* to the pipe *I* and the burners, where it is ignited by the flame at the pilot burner *g*, which is kept burning for the purpose. Other forms of equivalent igniting devices, such as an ordinary electric gaslighter actuated by the movement of the gas valve, may be employed for this purpose without departing from the spirit of my invention, though I prefer to use the pilot light, which is simple and certain in its operation. Air is drawn into the pipe *I* through the port *K*, by the injection of the gas from the nozzle *h* into the pipe *I*, and the quality of the gas is reduced so that a blue, smokeless flame is produced at the burners.

In case of a change in the gas pressure or in the quality of the gas the delivery of a changed quantity or quality of gas at the burners, which would otherwise occur, can be prevented by proper manipulation of the valve *F*, so that smoking of the flame can always be prevented. When water ceases to flow through the pipe *B*, the piston head *a* and spindle *b* are carried down by the weight *m*, and the valve *e* is closed, shutting off the supply of gas. The separation of the valve chambers by an open space instead of by a partition or diaphragm, as has been done in the attempts heretofore made to construct such an apparatus, permits any water that may escape from the valve *A* around the spindle *b* to flow away freely instead of entering the gas pipe, thereby choking it and putting stop to the operation of the apparatus, and at the same time provides an opportunity for the attachment of the lever and adjustable weight thereon, and also enables me to use other forms of valve in the gas pipe than the puppet valve hereinbefore described and illustrated in Fig. 1—such, for example, as the rotary chronometer valve illustrated in Figs. 2 and 3. In this case the lever *M* instead of being jointed and pivoted on the shell of the chamber *A* is rigid and attached directly to the stem of the gas valve *e*, which projects horizontally through the wall of the valve chamber. When water is drawn and the piston head *a* and spindle *b* rise, the lever *M* is lifted by means of the spindle *b*, turning the valve stem *P* and opening the ports of the gas valve, and when water ceases to flow the weight *m* depresses the lever, turning the valve stem *P* in the opposite direction and closing the valve.

By means of my improvements I provide a means for heating water by gas with the least possible consumption of fuel, which I have proven by actual use to be practical and certain in its operation and adaptable to the various conditions to which such a heater can be subjected.

I am aware that the automatic opening of a gas valve by means of the hydraulic pressure in a water pipe has heretofore been suggested and employed in connection with the so-called "geyser" water heaters. In all practicable forms of such apparatus, however, the water supply has been controlled by a manually operated valve located between the heating vessel and the source of supply in addition to the automatic valve in the water pipe, and the water has been discharged freely into the heating vessel instead of passing through it under pressure. With this arrangement it is necessary to locate the heater close to the point of consumption, with the attendant disadvantages of heat and vitiated air, instead of in the basement or at any convenient part of the building remote from the point of consumption, as in my device.

The importance of my invention will be readily apparent to those skilled in the art in which a practically working automatic device for the purpose has long been desired, but hitherto unknown.

It is apparent that where the pressure of the water, the pressure of the gas, and the quality of the gas are not liable to change the adjustability of the valve closing mechanism and adjustability of the gas supply opening *h* have their principal utility in adjusting the machine to the particular circumstances of each use when it is first set up.

By the expression "normally open water supply pipe" used in the claims I do not exclude the presence of the piston head *a* in the valve chamber *A*, which merely operates to effect the movement of the gas valve, but only any arrangement of cocks or valves by which in the normal operation of the device the connection between the heater and the water supply pipe will be shut off.

What I claim as new, and desire to secure by Letters Patent is:

1. In an automatic water heater the combination of a normally open water supply pipe, a water chamber in the water pipe, a piston head in said chamber adapted to be opened by the flow of water through the chamber and closed by gravity when the flow of water is stopped, a water heater located in the water pipe and arranged to be continuously filled with water, gas burners in operative proximity to the water heater, a gas pipe leading to the gas burners having an air induction port and a manually adjustable gas outlet, a gas valve chamber in the gas pipe separated from the water chamber by an interposed open space, a gas valve in the gas valve chamber, a valve stem connecting the gas valve with the said piston head, a lever pivoted to the valve stem and provided with an adjustable weight for assisting in closing the valve, and means for automatically igniting the gas at the burners, substantially as and for the purposes set forth.

2. In an automatic water heater the combination of a normally open water supply pipe, a water chamber in the water supply pipe, a piston head in the chamber adapted to be opened by the flow of water through the chamber and closed by gravity when the flow of water is stopped, a water heater located in the water pipe and arranged to be continuously

filled with water, gas burners in operative proximity to the water heater, a gas pipe leading to the gas burners having an air induction port and a manually adjustable gas outlet, a gas valve chamber in the gas pipe separated from the water chamber by an interposed open space, a gas valve in the gas valve chamber, a valve stem connecting said gas valve with said piston head, a weight connected with said stem for assisting in closing said valve and means for automatically igniting the gas at the burners, substantially as and for the purposes set forth.

3. In an automatic water heater the combination of a normally open water supply pipe, a chamber in the water supply pipe, a water heater located in the water pipe and arranged to be continuously filled with water, gas burners in operative proximity to the water heater, a gas pipe leading to the gas burners, a gas valve chamber in the gas pipe in alignment with the chamber in the water pipe and separated therefrom by an interposed open space, a gas valve in the gas valve chamber for controlling the flow of gas to the burners, a piston head in the chamber in the water pipe mechanically connected by a single stem with the gas valve and operating to open the gas valve when water is drawn from the heater and means for automatically igniting the gas at the burners, substantially as and for the purposes set forth.

Young and Glover's Naphthaline Remedy.[1]

At this year's meeting of the Gas Institute there was a paper by Mr. Wm. Young, of Peebles, and Mr. Thos. Glover, of West Bromwich, dealing with the naphthaline difficulty, and in which suggestions were made for overcoming it. The process sketched out in that paper has been patented, and in view of the importance and interest of the subject we now reproduce the patent specification practically in full. In the specification the name of Mr. Samuel Glover, of St. Helens, is associated with those of Mr. Young and Mr. Thos. Glover. The document (No. 20,125 of 1896) is practically as follows:

The Invention.—This invention relates to the manufacture of illuminating gas, and it comprises improved methods or processes having for their object the remedying of certain difficulties which have been experienced when coals are carbonized at very high temperatures with the view of producing a large volume of gas from a given weight of coal. When coals are carbonized at a very high temperature there is produced a large volume of gas but a comparatively small quantity of condensible hydrocarbons, in the form of tar, the large volume of gas being mostly derived from the decomposition of hydrocarbon products, which would be left as tar on carbonizing the coals at lower temperatures. The decomposition of the volatile and gaseous products from the coal, when carbonized at very high temperatures, has also the effect of considerably altering their constitution, for whilst lessening the yield of liquid products, the percentage of naphthaline is so largely increased that there is difficulty experienced in getting the liquid condensible products to take it up in solution during the condensing process, the consequence being that the gas is liable to carry forward in diffusion a part of the naphthaline, which is subsequently deposited during the distribution of the gas in the mains and services, more or less closing them up and giving much trouble in various ways. The gas produced from the coal carbonized at very high temperatures, although large in volume, has a low illuminating power.

The object of this invention is to overcome those difficulties, and it consists in providing and applying a supplementary supply of hydrocarbon fluids to wash or otherwise act upon the gases produced at high temperatures, so as either to absorb and remove the naphthaline ordinarily left in the cooled gas, or to carburet the gas in such a manner as will increase the illuminating power and prevent the naphthaline being deposited in the crystalline or solid form. This supplementary supply of hydrocarbon liquids for the treatment of the high temperature gas may be derived from various sources, dependent upon the convenience and economy in the supply and the treatment to which it is desired to submit the high temperature coal gases, and it may also be supplied in various stages during the process of manufacture, dependent upon the constitution of the hydrocarbon supply.

When the sole object is the removal of the naphthaline from the gases produced at high temperatures, any liquid hydrocarbon that has a large solvent power for naphthaline vapor may be employed, such as the distillates of ordinary coal or oil gas tars, or the distillate of the tars recovered from blast furnace gases, or other cheap hydrocarbon liquids. When such distillates contain naphthaline in solution they are cooled to a low temperature, which causes the naphthaline to separate in the crystalline form, when it is removed by filtration through any suitable filtering press. These hydrocarbon liquids so prepared are applied to the treatment of the high temperature gases by bringing them into intimate contact with such gases (in a manner similar to that by which water is employed to dissolve the ammonia out of the gas) in any convenient form of washer or scrubber, after the high temperature gases have been cooled and freed, as far as possible, from the high temperature tars and naphthaline.

When first brought into contact with the high temperature gases the solvent hydrocarbon liquids act somewhat differently, dependent upon their constitution. If of a high boiling point they will at first not only dissolve out of the gas the naphthaline, but also a part of the other hydrocarbon illuminants. On the other hand, if the hydrocarbon liquids having a low boiling point be present in the solvent hydrocarbon fluid they will, owing to their high vapor tension, be partially volatilized and diffused through the gas, whilst the naphthaline, owing to its comparatively low vapor tension, will be absorbed; but whatever may be the original constitution of the washing hydrocarbon liquids they, after a short time, either become saturated with the illuminants present in the gas or give up to the coal gas such a portion of the vapors of the volatile hydrocarbons that may be present in them as to bring about a balance of the affinities in those respects. Thereafter the solvent power of the washing liquid is confined to the dissolving of the naphthaline out of the gas. Or, instead of allowing the hydrocarbon liquids, with high boiling points, so employed to wash the gas to become saturated by dissolving the illuminants present in the gas, their solvent power may be restricted to the dissolving out of the naphthaline, by keeping them, by means of a steam coil or other equivalent, at a temperature sufficiently high to prevent them absorbing the illuminants having a high vapor tension, whilst yet low enough to allow them to absorb the naphthaline with the comparatively low vapor tension; or the absorbent liquid hydrocarbon may have added to it, prior to it being brought into contact with the gas, such quantity of volatile hydrocarbons as will limit the action of the absorbing fluid to the dissolving out of the naphthaline.

On the washing hydrocarbon liquid becoming so charged with naphthaline that it ceases to be effective in washing the gas it is drawn off from the scrubber and refrigerated, which causes the naphthaline held in solution to crystallize out, when it is separated by filtration. The washing hydrocarbon liquid is then returned to the scrubber for re-use. Should the high temperature gases not have been perfectly cooled or freed from tarry matters prior to being brought into contact with the washing hydrocarbon fluids, they become so contaminated with tarry matters that the naphthaline absorbed from the gas by the washing liquid cannot be separated by simply cooling and filtration. They require to be subjected to a preliminary distillation to fit them to undergo the filtering process.

How to Apply it.—In the case of a gas works where plant exists for the distillation of the ordinary coal tars this mode of applying the invention can be very conveniently carried into effect by collecting the early part of the distillate of the tar, separating the naphthaline which may be present in solution by refrigeration and filtration, and using this distillate so prepared in any convenient scrubbing or washing arrangement to wash the cooled high temperature gases and free them from naphthaline, whilst at the same time the benzol and the other hydrocarbons are volatilized into the gas, adding to the illuminating power. On the coal tar distillate ceasing to be effective in scrubbing the gas, it is either run direct to tar well, or sent back to the tar stills to undergo distillation and filtration, and may thus be prepared for re-use.

When the object is to carburet or increase the illuminating power of the gas produced from coal at high temperatures, whilst at the same time removing the naphthaline, or otherwise preventing its precipitation in the solid form, the necessary hydrocarbon liquids are specially produced or prepared for the purpose by subjecting some hydrocarbonaceous substance to carbonization or cracking up at such a low temperature, in any convenient retorting arrangement, as will insure the production of a considerable volume of high-quality gas and as large a production as possible of liquid hydrocarbon products as free from naphthaline as to be suitable to absorb the naphthaline from the coal gas produced at high temperatures, and containing volatile hydrocarbons suitable for being diffused through the high temperature gas, to add to its illuminating power and prevent any naphthaline that may escape absorption and accompany the gas from being subsequently deposited in the solid form.

The hydrocarbonaceous substance suitable for the production of the hydrocarbon fluids for the washing out of the naphthaline and the carbureting of the coal gas produced at high temperatures by carbonizing or cracking up at low temperatures are coals, shales, or other sim-

1. From the *Gas World.*

ilar solid bituminous substances, or liquid hydrocarbons that have been produced at low temperatures, such as blast-furnace, petroleum, or paraffine oils. The products resulting from the carbonizing or cracking up of those substances at low temperatures are brought into intimate contact (either whilst still hot and in the form of vapor suspended in the accompanying gas, or after having been cooled) with the coal gases that have been produced at high temperatures, after such gases have been cooled and freed as far as possible of the accompanying tars and naphthaline. The volatile products from the carbonizing or cracking up of the hydrocarbonaceous substances at low temperatures are thus diffused through the high temperature coal gas, whilst the low temperature condensed products are at the same time enabled to absorb the naphthaline; and should a part of the naphthaline escape absorption and pass away with the gas, it is either held in diffusion, or otherwise, prevented from being deposited in the solid form by being absorbed and dissolved by the accompanying condensible liquid products.

A Modification.—The condensed liquid products that have been thus once used to treat the coal gas, if found to contain considerable quantities of low temperature products (paraffines and olefines), are again subjected to further cracking up at low, but yet increased temperatures, so as to produce a further supply of liquid hydrocarbons free enough from naphthaline to enable them to be re used to absorb that substance from, and to carburet, the high temperature coal gases in the manner just described, the process being repeated till the quantities of naphthaline accumulating in the condensed products (due to the absorption of the naphthaline from the high temperature gas, or its production during the recarbonizing of the liquid products at the higher temperatures) interfere with their action as washing agents. They are then cooled and the crystallized naphthaline filtered out in the manner previously described.

A convenient method of carrying out this modification of the invention in existing works, involving little alteration or additions of plant, consists in dividing the retorts into two sections, a large section for the carbonizing of the coal at very high temperatures for the production of a large volume of gas, and a smaller section of the retorts for the distillation of a part of the same, or a higher quality of coal or shale, at a lower temperature to produce gas of a high illuminating power and a supply of condensible hydrocarbon products, suitable for carbureting the high temperature gases and of absorbing the naphthaline therefrom. The gases and products from the coal carbonized at the high temperatures are passed through the ordinary condensing plant in the usual manner. The gases and products coming from the coal or shale carbonized at the low temperature are conveyed by a separate pipe (preferably kept warm either by lagging with some non-conducting material or by means of a steam jacket or internal steam pipe) and commingled with the condensed high temperature coal gases after these gases have been condensed and freed, as far as possible, from tarry matters and naphthaline, at or near the terminal of the ordinary condensers.

In the case of a works where the ordinary condensers are of sufficient capacity, and provided with arrangements for drawing off the condensed products as precipitated, the low temperature gases and products are admitted into the terminal end of the condensing arrangement amongst the high temperature gases, and the latter part of the condenser employed to cool the combined gases; but where such is not the case a supplementary condenser or, preferably, a combined condenser and washer, must be provided for, bringing the two gases and low temperature products into intimate contact.

The denser hydrocarbon products left in the condenser or scrubber in which the high temperature coal gases are treated with the lower temperature products are somewhat differently dealt with, dependent upon their constitution, which, in turn, is dependent on the character of the coal or shale from which they have been produced and the temperature at which they have been carbonized.

When ordinary bituminous coal or the lower qualities of cannel or shale are the materials employed to produce the lower temperature products, the most convenient method is to carbonize them at such a low temperature as will produce condensible products which, whilst containing a low percentage of naphthaline, thereby enabling them to act as an efficient absorbent of naphthaline, will yet be sufficiently high to crack up the major part of the paraffines and produce a large percentage of the olefine and benzol group of hydrocarbons suitable to carburet the gas. In such a case the condensed lower temperature products are allowed to flow directly to the tar well, as they can, without injury, be commingled with the ordinary coal tars. On the other hand, when the higher qualities of cannel or shales are employed to produce the lower temperature products, the temperature employed to carbonize in the low temperature retorts may, with advantage, be lower, as higher results are obtained by subsequently recarbonizing the condensed low temperature liquid products. Besides, the tars from such high qualities of cannel and shales are, even when distilled at high temperatures, so rich in paraffines as to seriously deteriorate the quality of the coal tars when mixed with them. Under such conditions the condensed low temperature products left from the treating of the high temperature coal gases are drawn off from the terminal of the condenser or washer, separated and subjected to recarbonization by any of the well known methods of decomposing liquid hydrocarbons, the resulting products being re-used in washing the high temperature coal gases.

The proper temperature to employ in the lower temperature carbonizing process necessary to produce the desired results depends upon the original moleular structure of each coal, cannel or shale, and can only be ascertained by trial with each individual class of material, the tars being subjected to distillation and tested for the presence of paraffines and naphthaline by the usual well-known methods, and the temperatures of carbonization regulated accordingly.

Another Modification.—Another method of applying the invention, to prevent the precipitation of napathaline in the solid form from coal gases produced at high temperatures, is to volatilize into such naphthaline-charged gas the vapors of any convenient hydrocarbon having a solvent affinity for naphthaline, and also having a similar or approximate vapor tension, in such quantities that in the event of the naphthaline-charged gas being subsequently subjected to such a low temperature as to cause the naphthaline to precipitate from the gas, there will be simultaneously condensed such a proportion of liquid hydrocarbons as will dissolve it and hold it in solution. The liquid hydrocarbons suitable for such a purpose are the portions of the distillates of coal tars, blast-furnace tars, paraffine, and some varieties of petroleum oils whose solvent power for naphthaline is considerable and whose vapor tension approaches that of naphthaline; and they are volatilized into the naphthaline-charged gas in any convenient carbureting arrangement, in which the temperature and the quantity admitted can be so regulated as to cause the volatilization of the requisite quantity of such volatile hydrocarbon to produce the desired result. As the quantity of volatile hydrocarbons required varies, dependent upon their constitution, and the quantity of naphthaline in the gas, the necessary quantity under each circumstance must be ascertained by testing the gas leaving the carbureter, by passing through a tube cooled to a temperature to cause the precipitation of condensible products. If not sufficiently charged with the hydrocarbon liquid the naphthaline is deposited in a more or less solid form. If, on the other hand, more hydrocarbon liquid has been added than necessary the condensed matters will not only be liquid but will have absorbed a considerable portion of the illuminating vapor from the gas. The quantity has to be regulated to avoid either condition.

Natural Gas Production in the United States.

Advance sheets of the Eighteenth Annual Report of the United States Geological Survey, published last week in the *American Manufacturer*, and soon to appear, give the following, on the production of natural gas in the United States in 1896.

The difficulty of securing complete returns showing the total amount and value of natural gas consumed and the true condition of the fields that supply it makes this report in a manner incomplete, although nearly all of the large natural gas companies have furnished satisfactory returns to letters of inquiry. Yet the character of natural gas and the manner of its production and use make the collection of statistics concerning it more difficult and unsatisfactory than the collection of those pertaining to petroleum. Petroleum is of little value at the points of production. It must be sold in the crude state and afterwards transported to the refiner, who separates it into merchantable products. Natural gas, however, ueeds no process to make it marketable. It is always consumed in its natural condition except in a very few instances. Its consumption begins at the mouth of the well and ends at the last foot of the pipe line. It is often found associated with oil-bearing strata in the higher portions, the gas field forming for miles, as it does in many instances, a border to the oil fields. It is almost indispensable as fuel for drilling wells and pumping them and for operating the pumps that feed the pipe lines. There are a large number of persons associated with the production and transportation of oil and there are numerous farmers who consume large quantities of natural gas without payment, and therefore without record of value. It is probable that if all the natural gas thus consumed were reduced to the value of fuel displaced

Approximate Value of Natural Gas Produced in the United States from 1888 to 1896.

State.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.
Pennsylvania	$19,282,375	$11,593,989	$9,551,025	$7,834,016	$7,376,281	$6,488,000	$6,279,000	$5,852,000	a$5,528,610
New York	332,500	530,026	552,000	280,000	216,000	210,000	249,000	241,530	256,000
Ohio	1,500,000	5,215,669	4,684,300	3,076,325	2,136,000	1,510,000	1,276,100	1,255,700	1,172,400
West Virginia	100,000	12,000	5,400	35,000	500	123,000	395,000	100,000	b640,000
Indiana	1,320,000	2,075,702	2,302,500	3,942,500	4,716,000	5,718,000	5,437,000	5,203,200	c5,043,635
Illinois	.....	10,615	6,000	6,000	12,988	14,000	15,000	7,500	6,375
Kentucky	.....	2,580	30,000	38,903	43,175	68,500	89,200	98,700	99,000
Kansas	.....	15,873	12,000	5,500	40,795	50,000	86,600	112,400	124,750
Missouri	.....	35,687	10,500	1,500	3,775	2,100	4,500	3,500	1,500
Arkansas	.....	375		250	100	100	100	100	60
Texas	.....	1,728	6,000	.....	100	50	50	20	.....
Utah	.....	150		.....	.....	500	500	20,000	20,000
South Dakota	.....	25		.....	.....	.....	12,000	7,000	4,500
California	.....	12,680	33,000	30,000	55,000	62,000	60,350	55,000	55,682
Other States	75,000	1,600,000	1,600,000	250,000	200,000	100,000	50,000	50,000	50,000
Total	$22,629,875	$21,107,099	$18,792,725	$15,500,084	$14,800,714	$14,346,250	$13,954,400	$13,006,650	$13,002,512

a Includes $912,000 worth of gas produced in Pennsylvania but consumed in New York and Ohio.
b Includes $126,000 worth of gas produced in West Virginia but consumed in Ohio and Pennsylvania.
c Includes value of some gas produced in Indiana but consumed in Ohio and Illinois.

Natural Gas Records in 1895 and 1896.

	Pennsylvania		Indiana		Ohio	
	1895.	1896.	1895.	1896.	1895.	1896.
Amount received for sale of gas or value of gas consumed	$4,420,208	$4,054,791	$1,639,056	$1,589,276	$834,239	$706,212
Value of coal or wood displaced	$4,796,283	$4,162,845	$2,414,621	$2,208,910	$1,153,258	$788,262
Domestic fires supplied	182,944	171,104	72,019	62,991	45,537	33,982
Iron and steel works supplied	24	29	7	5	0	0
Glass works supplied	36	45	21	20	1	0
Other establishments supplied	580	648	414	583	158	198
Total establishments supplied	640	722	442	609	159	198
Total wells producing, January 1	1,409	1,522	787	931	310	307
Total producing wells drilled	217	200	189	182	78	39
Total wells producing, December 31	1,522	1,629	936	1,042	307	317
Total feet of pipe laid	20,950,905	23,430,836	10,774,780	11,484,329	4,083,050	4,099,864
Total establishments reporting	9	91	205	205	59	59

the total value would be increased at least 30 per cent. over the value of that transported and sold by regular pipe-line companies making returns. The declining pressure throughout the natural gas districts, as noted year after year, has continued during 1896. No new fields have been opened up, although several of the older ones have been extended. Several of the companies transporting gas have found their pipes too small, with the reduced pressure, to convey the gas to their consumers, and have added gas-compression pumps to their plants. In some instances the suction at these pumps in the lines leading from the wells is below that of the atmosphere. Of late a closer watch has been kept on the condition of the pipe lines, and the numerous small leaks at the joints and elsewhere, that were in former years neglected, are now more carefully repaired.

The natural enemy to the life of a gas well is water, generally salt water. The gas may at first be dry, owing to the heavy pressure holding it back, but as the pressure decreases water becomes noticeable. It may come from the gas rock just below the bottom of the hole, it may come in with the gas, or it may force its way past the packer. In any event, reduced pressure invites it, and this water must be removed or the life of the well is cut short. In former years it was the custom, and it is now to a great extent, to exhaust the water by what is known as "blowing the well." This consists in disconnecting the well from the main line and opening the gate at the top of the tubing, allowing the gas to discharge itself into the air. This it does in large volumes.

The general adoption of gas-saving appliances since the introduction of the meter has helped to cheapen natural gas in the household. The manner of consuming natural gas under boilers has been greatly improved in numerous instances. Instead of passing out of the open or perforated end of a pipe, the flow of gas is divided by a number of small openings, entangling a portion of air before the gas is ignited. The greater the number of these divisions and the lower the pressure, up to a certain limit, the more perfect will be the combustion.

The calorific value of natural gas as compared to artificial gases is generally quite high. Bulk for bulk, it is one-third greater than the ordinary illuminating coal gas, and about double that of enriched water gas. Both composition and calorific value vary somewhat from field to field. By calculating the value of the component parts of a number of gases from different fields Prof. F. C. Phillips, of the Western University, Allegheny, Pa., determined the range of from 1,110 to 1,300 pounds of water at the boiling point evaporated by 1,000 cubic feet of natural gas, the average being 1,205. This, multiplied by 966, the number of British heat units required to evaporate 1 pound of water, equals 1,164,030 British heat units in 1,000 cubic feet of natural gas of average quality. This high calorific value is of use for comparison, but is not reached in practice, although natural gas, when consumed with care, approaches it much nearer than any other fuel.

The following comparison gives the relative values of the different fuels in general use in boilers properly constructed and proportioned to their work.

Twenty cubic feet or 1 pound of natural gas will evaporate 20 pounds of water at 212°.

Sixteen cubic feet of natural gas or 1 pound of oil will evaporate 16 pounds of water at 212°.

Ten cubic feet of natural gas or 1 pound of coal will evaporate 10 pounds of water at 212°.

Ten cubic feet of natural gas, therefore, equals 1 pound of coal, or 20,000 cubic feet of natural gas equals 2,000 pounds or 1 short ton of coal; 4,800 cubic feet of natural gas equals 300 pounds of oil (1 barrel 34° B.); 4⅓ barrels of oil equals 1 ton of coal.

The recent improvements in the gas engine adapted for using natural gas have added much to its value, especially where the constant drains on the fields have lessened the production of the gas. The same amount of gas is capable of doing much more work when used in the gas engine than when it is burned under a boiler, as the following table comparing the different types of engines will show:

Fuel per Indicated Horse Power per Hour.

Type of Engine.	Equivalent of Gas and Coal. Gas. Cu. Ft.	Coal. Pounds.
Natural gas engine	13	1.3
Triple expansion condensing	16	1.6
Double expansion condensing	20	2.0
Single cylinder and cut-off	40	4.0
Ordinary high pressure with cut-off	75	7.5

The specific gravity of natural gas varies from 0.55 to 0.60 as compared to dry air at 60° F. and at an atmospheric pressure of 30 inches of mercury. Dry air at the above temperature and pressure weighs 76.5 pounds per 1,000 cubic feet. The composition of nearly all natural gas closely resembles marsh gas, CH_4. In the Appalachian gas the amount of nitrogen varies from 2 to 15 per cent. The paraffine series, whose composition is nearly equivalent to methane or marsh gas (75 per cent. of carbon and 25 per cent. of hydrogen), constitute 85 to 88 per cent. of the whole.

The Ohio and Indiana gas has about 0.20 per cent. of sulphureted hydrogen in its composition. The amount of air required to consume 1,000 cubic feet of natural gas of average composition is slightly less than 11,000 cubic feet, or about one part gas to 11 of air. In practice it

is best not to use the full amount necessary for complete combustion, and the proportion of one to ten will give better results.

The use of natural gas in connection with burners using a mantle of alkaline earth (thoria, etc.), has placed it at the head of the cheap illuminants where the gas can be had for 25 cents or less per 1,000 cubic feet, and as from 35 to 45-candle power can be secured by consuming 2½ cubic feet per hour, this natural product has little to fear from the competition of artificial gases or the electric light. Natural gas in an Argand burner, with a chimney, consuming 5 cubic feet per hour, furnishes about 12-candle power, and if consumed in an ordinary tip, using 5 or 6 cubic feet per hour, about 6-candle power. Some natural gases contain a very slight percentage of the heavier hydrocarbons, which adds considerably to their value as illuminants when used without the mantle.

The difficulty of securing any statement showing the full value of natural gas consumed has already been discussed. The manner of obtaining statistics and the number of companies reporting remain about the same from year to year, and therefore a comparison by years furnishes a true indication of the value and the conditions of production and sale of this unstable article. The prices have remained very nearly uniform during the years 1895 and 1896, and the value of the product therefore affords an index to the quantity consumed, since a large proportion of the gas during these years was measured by meters. Previous to 1894 the prices were much lower. A great amount was consumed unmeasured, and the money value does not very closely represent the the number of cubic feet. It will be noticed that the values for 1895 and 1896 are nearly identical.

In the table on the preceding page is given the approximate value of natural gas produced in the United States from 1888 to 1896, by States.

The table of natural gas records was compiled from the statements of all companies making full returns in 1895 and 1896. Many gas companies do not keep their accounts in such manner as to be able to furnish all of the information requested. In 1896 full returns were received from 355 companies and individuals—91 in Pennsylvania, 205 in Indiana, and 59 in Ohio, and these are compared with the reports made by the same companies in 1895.

In Pennsylvania the value of gas consumed by the 91 companies reporting in full was $4,054,791, out of a total for the State of $5,528,610, in Indiana the value reported by the 205 companies was $1,589,276, out of a total value of $5,043,635 for that State; in Ohio the value stated by the 59 companies reporting in full was $788,262, out of a total value of $1,172,400. These facts indicate that the returns from Pennsylvania are much more complete than those of the other States named.

The value of the coal and wood displaced in Pennsylvania is slightly greater than that of the natural gas; in Indiana and Ohio, on the contrary, the value of the gas is shown to be very much less than that of the wood and coal displaced. The gas market of northwestern Ohio and that of the Indiana field extend beyond the coal districts. In Pennsylvania a large proportion of the gas is consumed in the bituminous coal regions. The number of domestic fires shows a falling off in all three States, especially in Ohio. The number of wells drilled in Pennsylvania in 1895 and 1896 is nearly the same.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, ENGLAND, Sept. 10th, 1897.

Acetylene Gas.—The Incandescent Gas Burner in the Streets at Liverpool.—Naphthaline Troubles.

Notwithstanding the unpractical character of acetylene and its unsuitability in many respects for ordinary everyday operations, as compared with illuminating gas as manufactured and distributed by existing companies, the subject is a very fascinating one to inventors. Scarcely a day passes without an application referring to a "new and original" process for storing or generating acetylene, being deposited at the patent office. Nor is this a matter for surprise, bearing in mind the remarkable simplicity of the method by which it can be generated from calcium carbide, and the quality of the product as regards light producing powers. There is a remarkable feature, and that is the possibility, according to these inventors, of performing such a very elementary operation in so many hundreds—I might almost say thousands—of ways. But whatever the method used, the fact that a very large amount of light producing energy can be rendered available by means that might almost be called automatic, is extremely interesting to scientists, though not unlikely to prove a pitfall and a will-o'-the-wisp to the dabbler, whose knowledge of science dates only from the perusal of an ordinary text book. At the recent meeting of the North of Ireland Association of Gas Managers, a description of an apparatus claimed to be in use at a railway station in Ireland, and to yield satisfactory results, was submitted. But the event was shorn of much of the interest attaching to the advent of acetylene on such an occasion, by the fact that the author was not present.

The apparatus presents several features worthy of notice, and the designer has very wisely avoided attempting to automatically regulate the production according to the consumption. The generator is provided in duplicate, and resembles a small purifier box, being circular in plan and fitted with a removable lid which seals in a lute 12 inches deep. The gas outlet is in the side immediately below the lute, and there is a water supply consisting of funnel and U-tube, and an overflow with trap, just below the level of the gas outlet. The gas outlets of the two vessels are furnished with cocks and joined together by a tee piece. A series of horizontal trays are attached to a vertical central lifting rod, and there is a door at the base of each vessel for cleaning. The method of working will be obvious. The generators being connected up to a small washer, which is charged with solution of sulphate of copper for absorbing phosphoreted hydrogen, and a gasholder of ordinary construction, one of the generators receives a charge of 25 pounds of calcium carbide, placed on the trays. The lid is put on and clamped down, the outlet opened, and a regulated supply of water admitted by the funnel. Reaching the bottom tray first it causes evolution of acetylene to commence, and this is maintained as the water rises from tray to tray, and the rate of production can be adjusted by the water tap. When the charge is nearly worked off, or sooner if desirable, the second vessel is started in a similar way. By having a spare set of trays, which can be loaded before moving the cover, a fresh charge can be rapidly introduced.

There was some discussion as to the price of carbide per ton. One speaker who had tried to buy some was asked £45 per ton, and another put the price at £28. A ton will yield 8,000 to 10,000 cubic feet in practice, so at the lowest estimate the cost for material alone is somewhere about £3 per 1,000 cubic feet of gas. Prof. Macadam remarked on the danger due to the presence of phosphorus in the lime from which the carbide was made. It would lead to the production of spontaneously inflammable phosphoreted hydrogen, when water was added to the carbide. The presence of calcium sulphide in the carbide would cause great liabity to explosion. These compounds would be produced first, just when there was likely to be a trace of air left in the generator. After this explanation, it appears to be rather superfluous to use a solution of copper to remove an impurity, that if present at all, will probably blow the apparatus to pieces.

One of the most valuable contributions to the literature of public lighting is a report recently presented by Mr. C. R. Bellamy, the Superintendent of Street Lighting, to the Corporation of Liverpool. It includes full details of several experiments on a large scale with incandescent gas burners, and also an illustrated description of a lantern specially adopted for that purpose, having a lighting door at the top, so that the torch may be applied above the chimney. A large number of tests were made as to the actual illuminating power afforded by the burners, including not only new mantles, but also some that had been in actual use for varying periods of time. The maximum duty obtained was 20 candles per cubic foot of gas, and 13 candles was considered a fair average estimate throughout the life of the mantle in practice. The first test consisted of fixing 154 burners in ordinary high power lanterns, two or three in each. Though the saving in gas was large, there was extra expense for lighting and breakage. As the result of a year's working the average requirement per burner was 13 mantles, 12 chimneys and 3 rods. The pilot light was found to be unreliable, to deteriorate the mantle, and to use about 1,500 cubic feet of gas per annum, and altogether, with every possible care, the cost was found to be £1 4s. 6d. per annum beyond that of an ordinary burner. With a view of meeting these objections, a special lantern was devised, in which the gas could be used under the best conditions as regards ventilation, suitability of position, freedom from vibration and capability of being lighted by the ordinary torch and pole. Nearly 2,000 burners had been in use for 9 months under these improved conditions, including 901 lanterns and lighting 19 miles of streets. The ordinary lamplighters were not allowed to undertake the renewals of mantles, but a special staff of inspectors and fitters was employed for that purpose. It is thought that, eventually, the whole may be handed over to the care of the lamplighters. Many of the mantles lasted 6 months, some as long as 9, and the average requirement per burner per annum was only $2\frac{6}{10}$ mantles, and $2\frac{3}{10}$ chimneys, representing a cost of less than 4s. 6d. per annum. The first cost of a double burner incandescent, giving 80

candles power, was £2 7s. 5d. and the annual charge £3 12s. 9d.; a single light cost £1 17s. 4d., and £2 11s. 2d. per annum; while an ordinary 16-candle flat flame burner would be supplied for £1. 1s., and the annual charge was £2 6s. 3d. In concluding, the author states that the experiments conclusively prove that the incandescent cannot be used with complete success in the ordinary lantern, and therefore a somewhat heavy first cost is involved in the adoption of the system. But the advantages secured are so great that a general extension appears irresistible.

This is a powerful testimony from an independent source in favor of the new system. For the trifling charge of 16s. 4d. per lamp in the first place, and about 5s. more per annum, a 40 candle light can be obtained in place of a 16-candle. The writer has had an experiment, including the use of 8 incandescent burners in ordinary street lanterns on hand for 18 months, and found that, with no special precautions, the cost per burner per annum for renewals of mantles, etc., was under 8s., as compared with the ordinary flat flame lanterns. Special burners for street lamps, fitted with basin shaped bulbs instead of chimneys, can be obtained, and are a great improvement, reducing the breakage of glass to a mere nominal quantity. And in adopting the system on anything like a substantial scale, it is much the better plan to follow the Liverpool lead, and provide a complete new outfit, rather than to attempt to utilize the existing lanterns. By exercising a little judgment, and introducing the new system gradually, it is possible to avoid having old pattern lanterns left on hand. Apart from Liverpool, the success attained at Winchester and other towns has attracted attention, particularly in places where electric clouds are blowing up, and the present season will see a great extenston in the use of gas incandescent street lighting.

And this will tend to again raise the question of illuminating vs. heating power. In many districts 30 to 40 per cent. of the gas made is used for purposes other than lighting, which really means that its heating properties are turned to account, and not the illuminating ones. It is a question of heat units only, and a "blue" gas of similar heating value would answer just as well. Add to this the very large and increasing number of incandescent gas burners in use as coming under the same category, and it is evident that heat is gradually outstripping illumination. So it will not be long before the calorimeter will be a better practical test of the quality of the gas than the photometer. With this a different set of financial conditions will come in, as the supply of heat units is a different thing from furnishing candle power. Beyond the fact that a high quality illuminating gas is slightly better than a low quality, there is no connection between photometrical and calorific value, and the question of getting the highest possible yield of heating value per ton of coal is different from working with candle feet in view.

Some interesting information on the vagaries of naphthaline deposits is afforded by a communication presented at the recent meeting of the French Society of Gas Managers. For 25 years the taps on the street lamps of a town in Russia had been placed below and outside the lanterns. The variations of temperature range from 50° to 120° F., and no trouble from stoppages was experienced. But the introduction of generator furnaces at the gas works had the unexpected and undesirable effect of causing naphthaline deposits at the taps. After some experiments, the taps were placed inside the lantern, about 3 inches below the flame, and this obviated further trouble, though slight deposits are occasionally found in the service pipes. Obstructions removed from service pipes were examined, and the author experimented and discovered that he could produce them by artificial means, and came to the conclusion that condensation by cooling, and re-evaporation by raising of temperature is continually going on in a system of gas pipes, to an extent proportioned to the variations in temperature. This is all in accordance with general experience. It is well known that the naphthaline difficulty runs side by side with high yields per ton, and that gas produced under such conditions will "deposit" upon the slightest inducement in the way of change of temperature. Complaints as to quality of the gas usually make their appearance with the first autumn frost, so that it is a very general practice to take extra care in the way of keeping up the illuminating power at this season of the year. Contact with damp earth, or a sudden constriction or blank end, will also assist in securing this undesirable visitor to the interior of the main or service. The success of the operation above mentioned would appear to be due to the fact that the gas is burning throughout the night, at the time when the lowest extremes of temperature prevail. And it is evident that gas managers who want to enjoy freedom from the naphthaline bogey must be satisfied with moderate yields in the retort house, and must take every care to protect the mains and services from extreme variations of temperature. It has been pointed out that careful condensation is a powerful factor in this matter, but I have not seen any report showing how far improvements in that respect may be adopted as a cure. In the usual way, condensation is conducted in a somewhat rough-and-ready manner, the external air being left to do the work, without regard to climatic variations of temperature, or to the quantity of gas to be treated from day to day. If the condensers could be immersed in water, inclosed, or otherwise put under control, so that the cooling could be adjusted as desired, some useful, practical information could be obtained.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE proprietors of the Phœnix Gas Company, of Fishkill, N. Y., give notice that, until further notice, Mr. Calvin Bushnell is their authorized agent for the collection of all moneys due the Company.

THE committee chosen by the shareholders of the Louisville (Ky.) Gas Company, consisting of Messrs. Udolpho Snead (Chairman), W. H. McKnight and K. W. Smith, of Louisville, and J. A. Cheek, of Danville, Ky., have now deposited under their control 22,248 shares of stock out of a total of 26,750 shares owned by individual stockholders. Said stock has been deposited with the Fidelity Trust and Safety Vault Company, the Louisville Trust Company, and the Columbia Finance and Trust Company, of Louisville. The stockholders' committee is empowered to sell the controlling interest in the Louisville Company at a price not less than $110 per share and is ready to negotiate with intending purchasers. The total capital stock of the Company is $3,600,000, of which the city of Louisville owns $925,000

MESSRS. MARIS BROTHERS, of Philadelphia, Pa., manufacturers of traveling cranes, are erecting a new machine shop to meet the demands of their increased business. The new building will be modern, and designed to meet all the requirements of a handy and serviceable machine working establishment. The main building is to be 55 feet by 75 feet, and running its full length will be a 10-ton power crane, having a span of 30 feet. One side of the building will carry a gallery on which will be placed the lighter machinery. The framework of the structure is to be of steel, and its roofs and sides are to be covered with corrugated iron. The design for the building was mapped by the Berlin Iron Bridge Company, of East Berlin, Conn., and the designers will furnish and erect all the material.

MR. W. H. TAYLOR has completed the work of overhauling the plant of the Suffolk Gas Light Company, of Bay Shore, L. I.

MR. STEPHEN W. CAREY has been chosen to succeed the late Dr. John J. H. Love as President of the Montclair Gas and Water Company, of Bloomfield, N. J. The vacancy in the Board of Directors was filled by the election of Mr. Joseph Van Vleck.

THE proprietors of the Brantford (Ont.) Gas Company have determined to construct a new gasholder; a determination that might better have been reached at least five years ago.

THE commission appointed to condemn the property of the Le Roy (N. Y.) Gas Light Company, under an order authorizing the authorities of that place to acquire the property named for operation on municipal account, is taking testimony. The Commissioners are: Messrs. W. C. Watson, W. T. Mylcraine and H. T. Miller, of Batavia. The village of Le Roy is represented by Mr. F. S. Randall, of Le Roy, and the Company's case is being managed by Mr. George Bowen.

AT an adjourned annual meeting of the Spencer (Mass.) Gas Company the old board of officers was re-elected. That result, however, was not obtained until a very vigorous opposition by the minority shareholders had been put forth.

A CORRESPONDENT forwards the following: "At a recent meeting of the Directors of the Beverly (Mass.) Gas and Electric Company, it was voted to reduce the gross rate per 1,000 cubic feet to $1.90, prompt payment of accounts to entitle the consumer to a rebate of 20 cents per 1,000. This is the second reduction within a twelvemonth, and it will be followed by another as soon as the increased use of gas permits. The Company also announces its willingness to extend its mains in any section of the city, where the interest on the expense of putting down the pipes will be guaranteed through the receipts from gas supplied. The Company further agrees to put in services, from mains to house pipes, without charge."

THE Welsbach street lamps (200 in number) recently erected by the Worcester (Mass.) Gas Company, are giving fairly good satisfaction.

THE growth of the Elizabeth (N. J.) Company's business is little short of phenomenal.

THE residents of Palo Alto, Cal., evidently are not favorably disposed over the petition of Mr. Edwin Fish and associates for the right to construct and operate a gas works in Palo Alto, as the following remonstrance in opposition (signed by 45 prominent business men of the place), submitted to the City Council will show: "To the Honorable Board of Trustees: Gentlemen, We, the undersigned property owners and residents of Palo Alto, most earnestly protest to your honorable body against the erection of a gas plant within the corporate limits of Palo Alto, for the following reasons:

"1. It will be a standing menace to the community.

"2. The noxious gases emanating from it will be injurious to the public health, and will also prevent people from becoming residents of said town.

"3. It will greatly reduce the valuation of property.

"4. The real purpose of the Gas Company in asking for a franchise is to shut off all possible competition in the future.

"5. The proposed plant will be cheaply constructed, and deficient in modern merit and invention.

"6. At present there is no need of a gas plant in Palo Alto.

"Your petitioners fully recognize the value of gas as a public utility and are not adverse to the granting of a franchise to responsible persons, provided, that the plant to be erected shall be strictly first-class and be located in the suburbs of the town, but not in any of the residence portion thereof."

MR. EDWIN FISH, the Manager of the Peninsula Lighting Company, for such is the corporate title of the applying corporation, naturally was very much disgruntled at this "pronouncement of the citizens," and in refutation thereof said, in substance, to the Board that the plant which his Company proposed to erect would be so constructed that it would be entirely free from escaping odors of gas; that the gas to be manufactured would be the finest sort of coal gas; and that if the plant, when located on the original site chosen, should prove objectionable, it would be removed to a site beyond the town limits. The whole matter was referred to the Gas Committee.

THE City Council of Chehalis, Wash., has determined to lease the hitherto municipally-conducted electric lighting plant of that place to private capitalists; thus virtually confessing that the "public ownership of quasi public monopolies" is a delusion and an extravagance.

THE Middletown (Conn.) Gas Light Company is comfortably and satisfactorily installed in its handsome, new office quarters. In the showroom has been placed a very complete line of cookers, heaters, improved burners, etc.

THE Directors of the Amherst (Mass.) Gas Company have declared a semi-annual dividend of 2 per cent., payable October 1st. The dividend for the first half of the year was 3 per cent.

A CORRESPONDENT in Toronto, writing under date of the 21st inst., says: "The proprietors of the Manitoba Electric and Gas Light Company, of Winnipeg, B. C., in addition to the extension of the mains, work on which is progressing so satisfactorily that the plan will be completed before frost sets in, have determined to construct a gasholder equal to the storing of 300,000 cubic feet. It may be that this holder will not be erected before next spring."

MR. SWEETMAN, formerly of Kansas City, Mo., is an applicant for an opposition gas franchise for St. Louis, Mo. As Mr. Sweetman is not a capitalist, and as Mr. Snyder, who formerly employed Mr. Sweetman, during their joint sojourn in Kansas City, is reputed to have made money out of the Kansas City gas supply consolidation, it is fair to assume that Sweetman really means Snyder in this St. Louis scheme.

IN response to the invitation of the authorities for proposals for the public lighting of Lorain, O., the following bids were received: The Wright Gas Company, lighting schedule to midnight, incandescent gas burners, 5-year contract, $1.75 per lamp per month; ordinary burners, $1.40 per lamp per month; 10-year contract, similar conditions, $1.65 and $1.35; a lighting schedule on moontable basis, 5-year term, incandescent burners, $1.87½; ordinary burners, $1.50 per lamp per month; 10-year term, $1.75 and $1.37½.

THE following is the text of the application of the projectors of the Flushing (L. I.) Union Gas Company, who are before the Trustees of Flushing for the right to operate an opposition gas plant in the place named:

"To the Trustees of the Village of Flushing—The undersigned respectfully show: That the Flushing Union Gas Company is a corporation duly organized and existing pursuant to the provisions of chapter 566 of the Laws of 1890, and the various Acts amendatory thereof and supplementary thereto, and was duly incorporated in the year 1897 for the purpose of manufacturing and supplying gas for lighting the streets and public and private buildings of the villages within the town of Flushing, and of the towns and villages not over 5 miles distant from said town of Flushing, in the State of New York, and for manufacturing and using electricity for producing light, heat and power, and in lighting streets, avenues, public parks and places and public and private buildings of cities, villages and towns within this State, and has filed its certificate of incorporation in the offices of the Secretary of State of the State of New York, and has paid to said Secretary of State the fees payable thereon, and has likewise paid to the Treasurer of the State of New York the corporate tax due and payable upon such incorporation, and has filed in the office of the County Clerk of Queens county its duplicate certificate of incorporation. Your petitioner shows that it is desirous of commencing its operations and forthwith entering upon the performance of the business for which it was incorporated within the village of Flushing, and to that end desires permission to lay conduits for conducting gas through the streets, lanes, alleys, squares and highways in said village, and to lay, erect and construct suitable wires or other conductors with the necessary poles, pipes or other fixtures, in, on, over and under the streets, avenues, public parks and places of such village, for conducting and distributing electricity, and for that purpose makes application to the municipal authorities of the village of Flushing for power to lay conductors for conducting gas through the streets, lanes, alleys, squares and highways in said village, and to lay, erect and construct suitable wires or other conductors with necessary poles, etc., on the streets of said village for conducting and distributing electricity, and to be exempted from taxation upon its personal property for a period not to exceed three years from its organization.—THE FLUSHING UNION GAS COMPANY, by EDWIN LUDLAM, President."

THE application will be considered at the October meeting of the Board, the postponement of action being chargeable to the absence of Mr. Jas. A. McDonald, President of the Flushing Board of Trustees.

THE initial capital stock of the Flushing Union Gas Company is $25,000, and the Directors are: Messrs. Edwin Ludlam, W. K. Rossiter, J. H. Jourdan, Charles W. Blodget and James C. Bergen, all of whom are prominent in the management of the Brooklyn Union Gas Company.

AT the annual meeting of the Worcester (Mass.) Gas Light Company the officers chosen were: Directors, Jas. P. Hamilton, Chas. D. Lamson, A. George Bullock, Josiah H. Clarke, Francis H. Dewey, Albert Wood and Samuel B. Woodward; President and General Manager, Charles D. Lamson; Clerk and Treasurer, James P. Hamilton. From the annual reports it was shown that the output for the year was 201,147,900 cubic feet, equivalent to an increase over that for 1896 amounting to 4.4 per cent. The meters in use number 7,124; and the main mileage equals 74.8. The Company is in exceedingly prosperous condition.

MR. W. BAILEY has been appointed Superintendent of the Oskaloosa (Ia.) Gas Company.

THE rate for gas for cooking, heating and power purposes for Alexandria, Va., has been reduced to $1.10 per 1,000 cubic feet.

THE Directors chosen by the proprietors of the Lewiston (Me.) Gas Light Company at their last annual meeting were: W. H. White, S. M. Carter, Edward C. Lee, Samuel T. Bodine and Randal Morgan.

MESSRS. H. J. BURT & SONS, writing to us from Liberty, Ind., under date of the 21st inst., say that they have secured a franchise for the construction and operation of a gas works at Hicksville, O. The franchise is to last for 30 years, and the Company cannot charge in excess of $1.50 per 1,000 for an illuminating supply, the rate for a fuel gas supply to be $1 or under. The "Burt" system of gas manufacture is to be followed—whatever that system may be. Work of construction will be commenced at once. Hicksville is in Hicksville township, Defiance county, O., and is located on the Chicago division of the Baltimore and Ohio Railroad, at a point 20 miles west of Defiance. It is supported by numerous manufacturing interests of great diversity, and has a population of perhaps 3,600.

THE AMERICAN GAS LIGHT JOURNAL

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PROPRIETORS.

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CHAS. E. SANDERSON,

MANAGER.

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MONDAY, SEPTEMBER 27, 1897.

The Market for Gas Securities.

The events of the week in the trading in local gas securities were of an order sensational enough to satisfy even the most pronounced seekers for spectacular effect. Saturday last, under realizing sales and orders for the short side, a sharp break in Consolidated took place. The decline carried through the early part of the week, until the low point of 215 was reached. A sharp reaction to 222 followed, and a further rise culminated yesterday in the high price of 237. To-day (Friday) the opening was made at 230½ to 231, and at time of writing (2 P.M.) sales were reported at 226. These changes are sufficiently varied to suit anybody. Meanwhile our belief is that the stock is a purchase. Other city shares (notably Mutual, which is 400 bid) are dull and strong.

Brooklyn Union is 129 to 130, a net loss for the week of five points; the bonds are 113 to 114.

Chicago gas is steady, at a loss of about a point from last quotation.

Bay State is said now to have a capitalization of $35,000,000. The new issue of $20,000,000 will be explained later, by the acting President, Mr. J. Edward Addicks. The "security" sold to-day at 8.

Consolidated, of Baltimore, is steady, and Consumers, of Jersey City, is inquired for at much better rates than have prevailed in it for some time.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 WALL ST., NEW YORK CITY.

SEPTEMBER 27.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,430,000	100	223	225
Central	500,000	50	195	..
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	295	298
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	400	410
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150,000	50	85	
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	90	92
Preferred	2,000,000	100	115⅛	117
Bonds 1st 5's	3,500,000	1,000	112	113
" 1st Con. 5's	1,500,000	..	105	106⅛
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	155	160
Preferred	5,000,000	100	165	170
Bonds, 1st Mortgage, 5's	1,500,000	1,000	114	115
Yonkers	299,650	50	130	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	129	130
" " Bonds (5's)	15 000,000	1,000	113	114
Bay State	15,000,000	50	8	8¼
" Income Bonds	2,000,000	1,000	..	35
Boston United Gas Co.—				
1s Series S. F. Trust	7,000,000	1,000	93	..
2d " " "	3,000,000	1,000	80	81
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	106⅜	106½
Chicago Gas Lt. & Coke Co. Guaranteed Gold Bonds.	7,650,000	1,000	104	104¼
Columbus	1,069,000	.	90	91
1st Mortgage	1,085,000	..	..	96
Consumers. Jersey City	2,000,000	100	75	85
" Bonds	600,000	1,000	103	105
Cincinnati G. & C. Co.	8,500,000	100	203½	208¾
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000		
Consolidated, Baltimore	1,000,000	100	60¾	61
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000		50	50½
" Con. Bonds	4,312,000	..	93½	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	83	84
" Bonds	2,000,000	..	93	95
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	145	150
" Bonds, 6's	2,650,000	..	107	109
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	88	89
Bonds	1,000,000	1,000	92	94
Louisville	2,570,000	50	.	..
Laclede, St. Louis	7,500,000	100	42½	42¾
Preferred	2,500,000	100	93	95
Bonds	9,034,400	1,000	103	104
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	142	..
Bonds, 6's	4,000,000	..	123	..
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	53½	54
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,00	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	83	..
Consolidated 5's	2,000,000		87½	90
San Francisco, Cal.	10.000,000	100	94	94½
St. Paul Gas Light Co.	1,500,000	100	49	51
1st Mortgage, 6's	650,000	..	84	87
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	2,500.000	25	32½	34
Bonds	1,000 000		98	100
Washington, D. C.	2,000,000	20	250	
Western, Milwaukee	4,000,000	100	86½	87½
Bonds, 5's	3,556,000	.	98	100
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STEAM BLOWER FOR BURNING BREEZE.

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CANNEL COALS.

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The P. H. & F. M. Roots Co., Connersville, Ind 501
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Davis & Farnum Mfg. Co., Waltham, Mass 512
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DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO., 813 DREXEL BUILDING, PHILA., Sept. 22, 1897.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable on Oct. 15, 1897, to stockholders of record at the close of business Sept. 30th. Checks will be mailed.

1164-3 EDWARD C. LEE, Treasurer.

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The advertiser, who has had great success in building up business of Gas and Electric Light Plants, desires to lease a Gas or Gas and Electric Light Plant in a city of 3,000 to 5,000 inhabitants, or would accept management of such plant.

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in a Southern city of 3,800 inhabitants.

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Hydraulic, Dip, Branch and Ascension Pipes, Mouthpieces and Lids, for four Benches of 5's and for one Bench of 3 retorts.

Two Coolers, or Air Condensers, each of 150'000 cubic feet capacity.

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8-inch Center Seal. Four Purifiers, 8 ft. x 6 ft.

KEY CITY GAS CO.,
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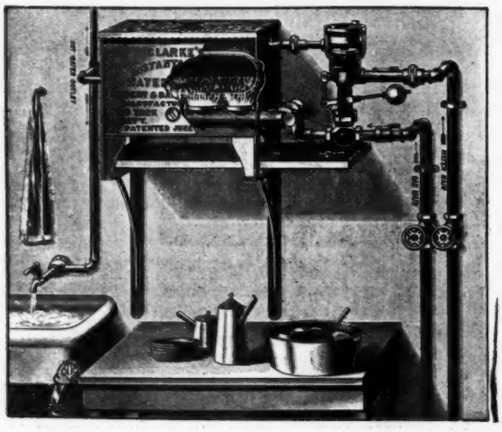

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This Heater furnishes water heated as it flows. The act of drawing water from any faucet with which it is connected automatically turns on the gas, which is in the same way instantly shut off when the flow of water is stopped at the faucet. It will deliver a gallon of water a minute as long as required, at a temperature 80° higher than it is delivered to the Heater; or it will deliver a less amount at a higher temperature, or a greater amount at a lower temperature, as may be determined by regulating the flow at a faucet. We have testimonial letters from those using it in Private Residences, Factories, Barber Shops, Restaurants, Stables, Laboratories, Stores, Churches, Commercial Buildings (for scrubbing), Banks, Clubs (baths, shower baths and sprays), Hotels, Riding Academies (baths and shower baths), and Patrol Stations

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Not Expensive., Write to
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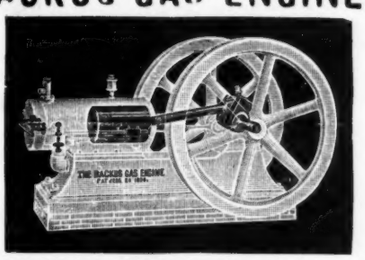

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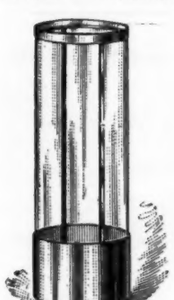

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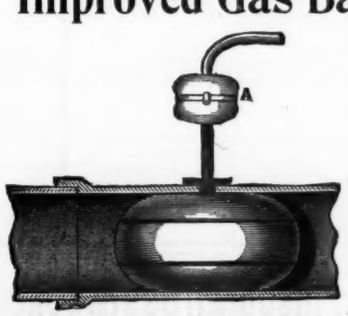

These Gas Bags are used to stop the flow of gas while repairing or making alterations in gas mains. There have been numerous cases of workmen being badly injured, and some times fatally, by the escape of gas resulting from the bursting of a bag, and our patent improvement is designed to obviate such calamities. The indicator *A* shows unerringly when the bag has been sufficiently inflated to pack the main, and when the pumping should be stopped. Our Bags are made of a rubber stock especially prepared to admit of great distension, and to resist the action of Oils, Gases, Naphtha and other residuum in the mains, and they are made with lapped joints, which adds greatly to their strength.

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5 "	"	"	1.05	20 "	"	"	12.00
6 "	"	"	1.75	24 "	"	"	17.00
8 "	"	"	2.65	30 "	"	"	27.50
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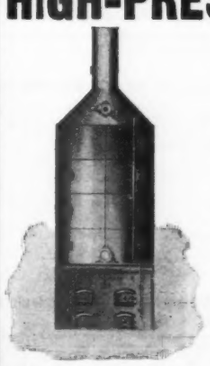

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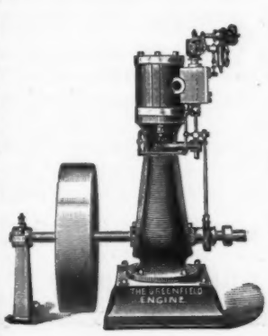

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Are Suitable for All Pressures and Conditions, and for Efficiency, Economy and Durability are Unrivaled.

Producing a steady, well-shaped flame with burner cock turned on full. Prevent waste of gas, broken globes and dissatisfied consumers.

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Every Burner is stamped with name and trade mark. Cheap and inferior imitations are constantly coming in and going out of use, and we respectfully warn the trade against this kind of deception, as it causes loss and discredit to the trade and damage to the gas industry.

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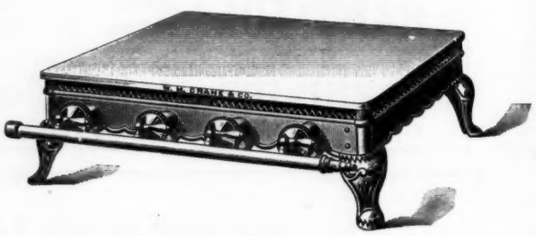

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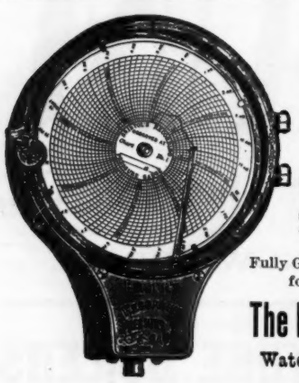

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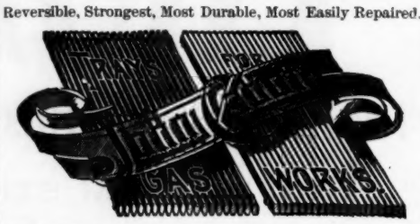

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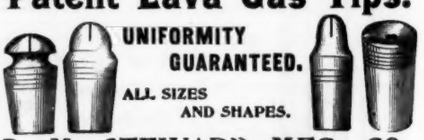

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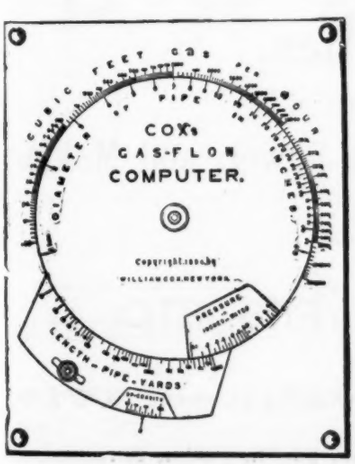

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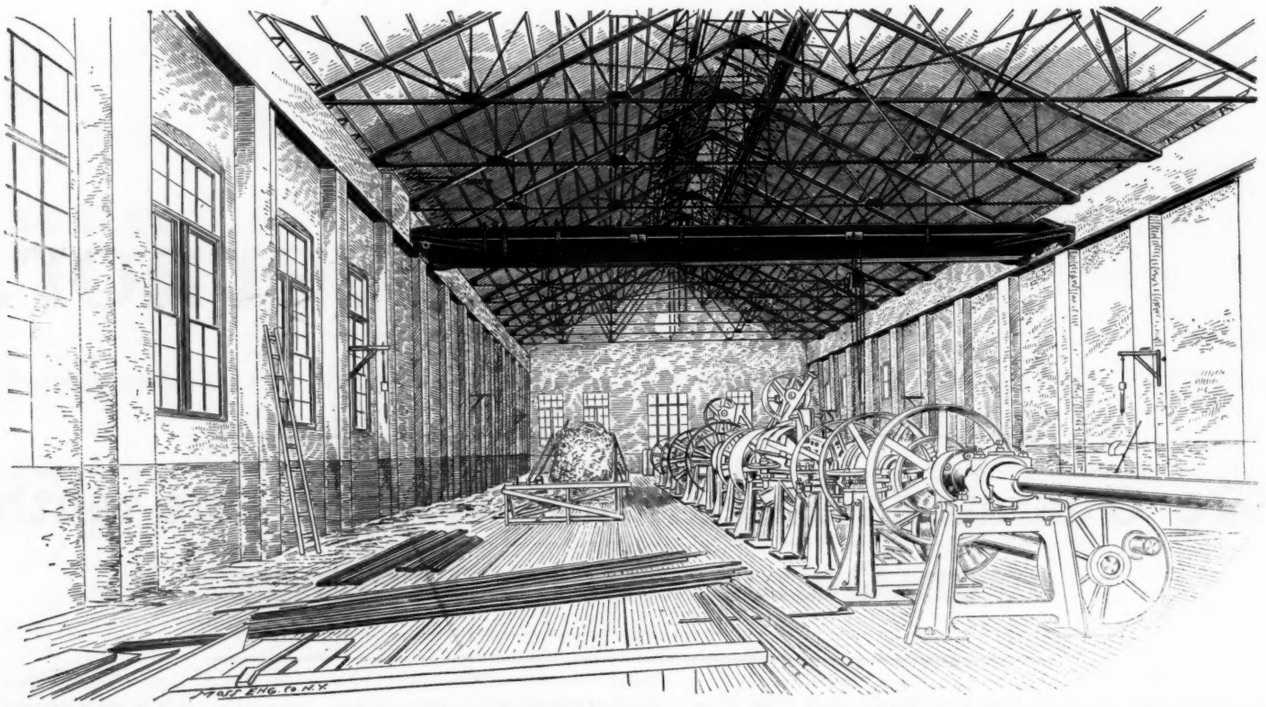

The above illustration is taken direct from a photograph, and shows the interior of the Dynamo Room in the Electric Lighting Plant of the Elmira Electric Illuminating Company, at Elmira, N. Y. Besides this, there is a Boiler and Engine Room adjacent to the Dynamo Room. We furnished the Traveling Crane as well as the Iron Roof. The roof is covered with our Patent Anti-Condensation Corrugated Iron, and is guaranteed absolutely fireproof, and not to drip from the under-side during the coldest weather. The photograph was taken after the Roof Trusses and Traveling Crane were placed, but before the machinery was started.

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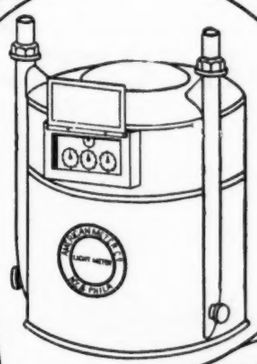
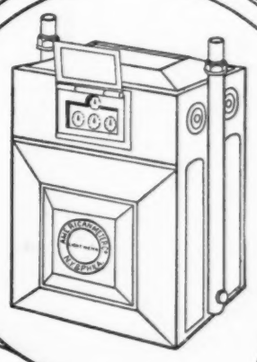
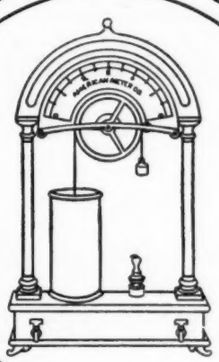


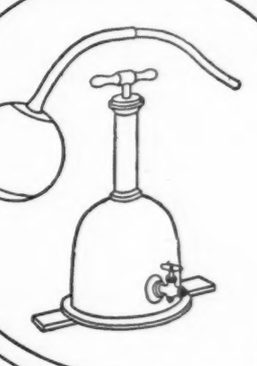


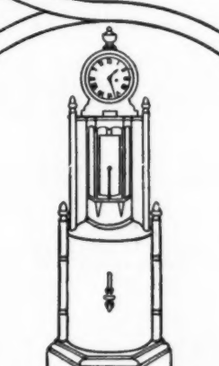


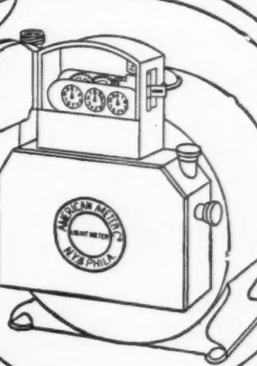
PUBLIC LIGHTING TABLE.

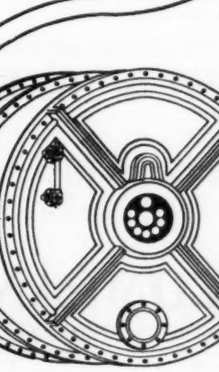
OCTOBER, 1897.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Fri.	1	8.10 PM	5.00 AM	5.30	5.00
Sat.	2	9.20 FQ	5.00	5.30	5.00
Sun.	3	10.30	5.00	5.30	5.00
Mon.	4	11.40	5.00	5.30	5.00
Tue.	5	12.50 AM	5.00	5.30	5.00
Wed.	6	1.50	5.00	5.30	5.00
Thu.	7	3.00	5.00	5.30	5.00
Fri.	8	4.00	5.00	5.20	5.10
Sat.	9	No L.	No L.	5.20	5.10
Sun.	10	No L. FM	No L.	5.20	5.10
Mon.	11	No L.	No L.	5.20	5.10
Tue.	12	5.50 PM	7.00 PM	5.20	5.10
Wed.	13	5.50	7.40	5.20	5.10
Thu.	14	5.50	8.20	5.20	5.10
Fri.	15	5.50	9.00	5.10	5.20
Sat.	16	5.50	10.00	5.10	5.20
Sun.	17	5.40	11.00	5.10	5.20
Mon.	18	5.40 LQ	12.00 AM	5.10	5.20
Tue.	19	5.40	1.00	5.10	5.20
Wed.	20	5.40	2.10	5.10	5.20
Thu.	21	5.40	3.20	5.10	5.20
Fri.	22	5.40	5.20	5.00	5.30
Sat.	23	5.40	5.20	5.00	5.30
Sun.	24	5.30	5.20	5.00	5.30
Mon.	25	5.30 NM	5.20	5.00	5.30
Tue.	26	5.30	5.20	5.00	5.30
Wed.	27	5.30	5.20	5.00	5.30
Thu.	28	5.30	5.20	5.00	5.30
Fri.	29	5.30	5.20	4.45	5.35
Sat.	30	8.20	5.20	4.45	5.35
Sun.	31	9.30	5.30	4.45	5.35









TOTAL HOURS LIGHTING DURING 1897.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	233.00	January	423.20
February	187.20	February	355.25
March	202.00	March	355.35
April	170.40	April	298.50
May	163.00	May	264.50
June	140.40	June	234.25
July	151.40	July	243.45
August	167.30	August	280.25
September	174.40	September	321.15
October	200.00	October	374.30
November	205.20	November	401.40
December	220.10	December	433.45
Total, yr.	2216.00	Total, yr.	3987.45

To Whom It May Concern.

WE have learned that the makers of the "Sunlight" lamp assert that there has been a decision in the English Courts which saves them and their customers from liability as infringers of the Welsbach patents.

We assure the public there is no decision of any Court, in England or elsewhere, that directly or indirectly warrants the statement or inference that the lamp sold by the Sunlight Incandescent Gas Lamp Company of America is not an infringement of the Welsbach Light as made under the American patents, of which the Welsbach Light Company is sole and exclusive owner.

NOTICE is hereby given to all PURCHASERS and USERS of the so-called "Sunlight" lamp that suits will be brought against them for DAMAGES for INFRINGEMENT of the Letters Patent of the Welsbach Light Company, and will be prosecuted vigorously.

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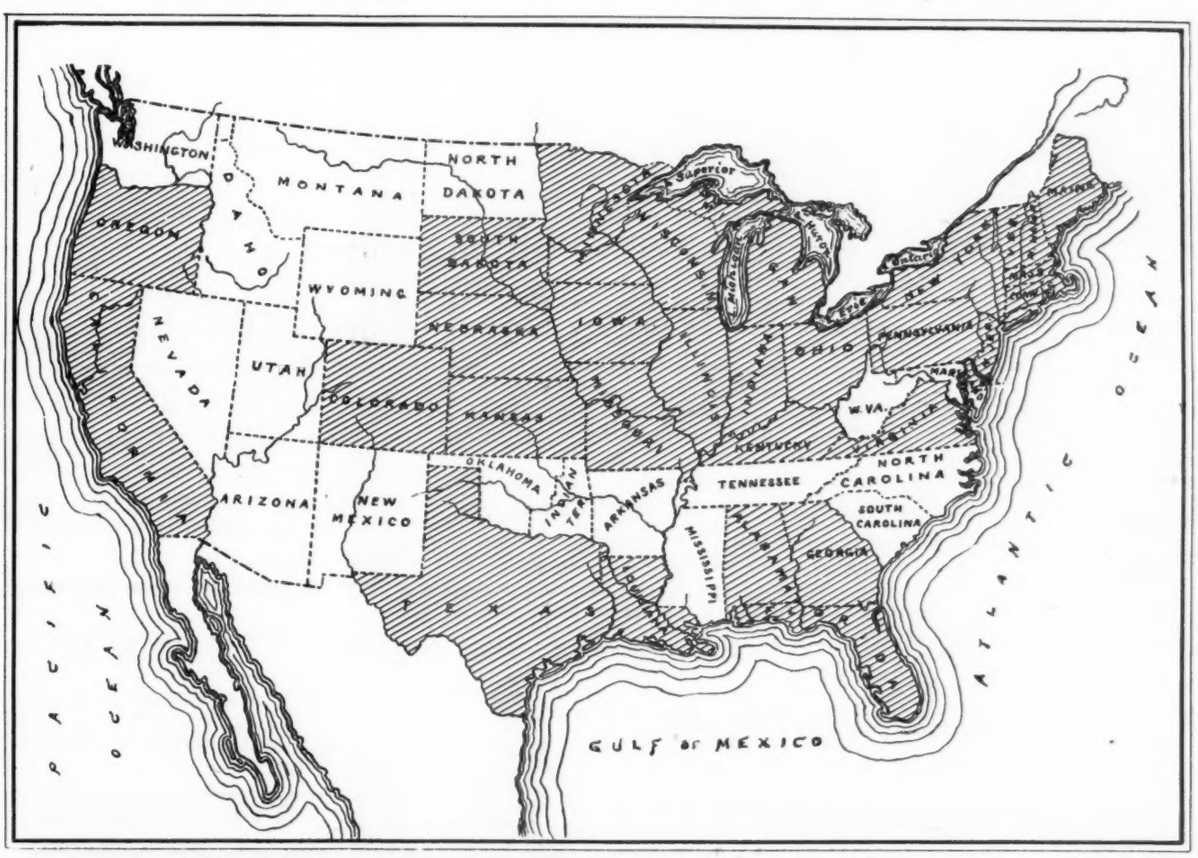

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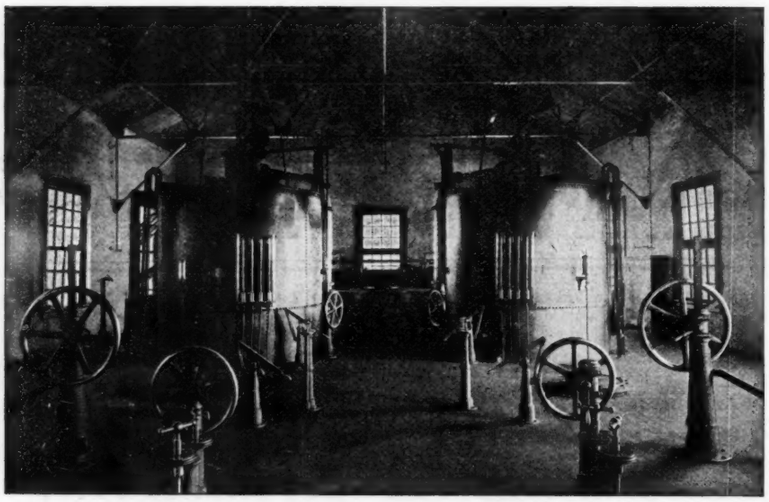

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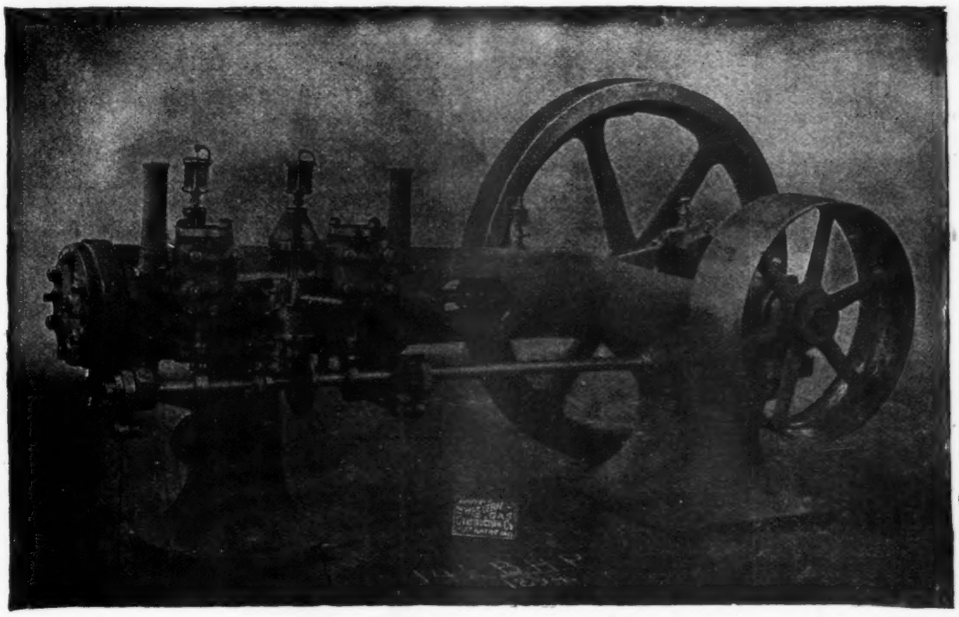

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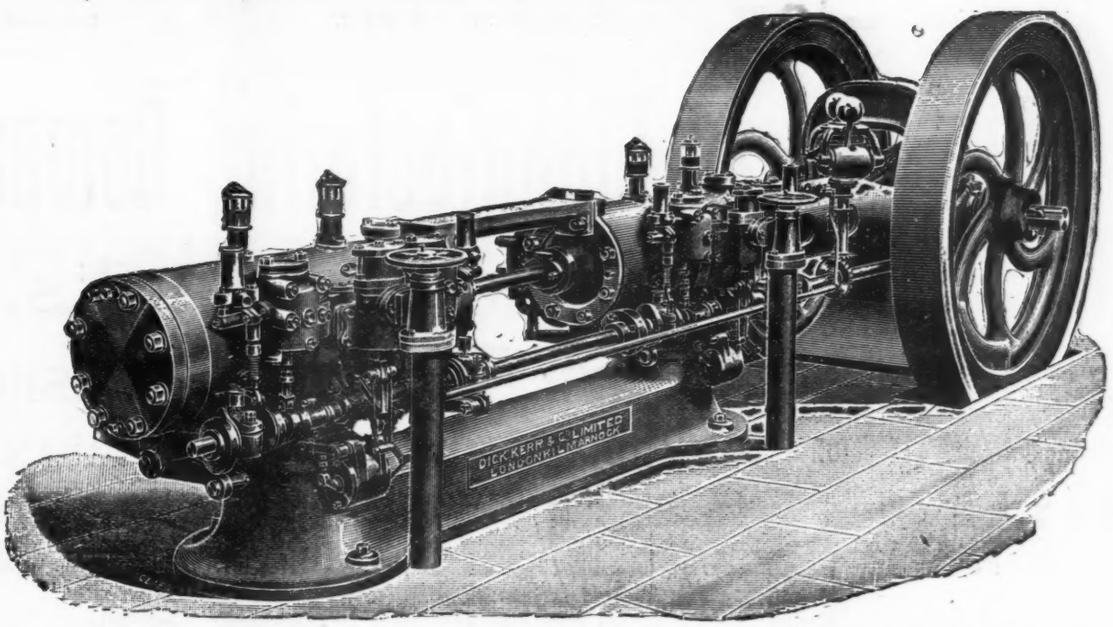

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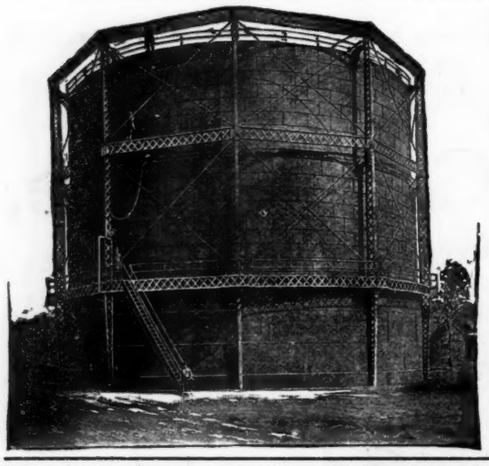

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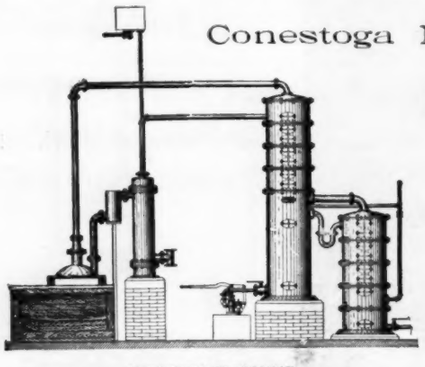

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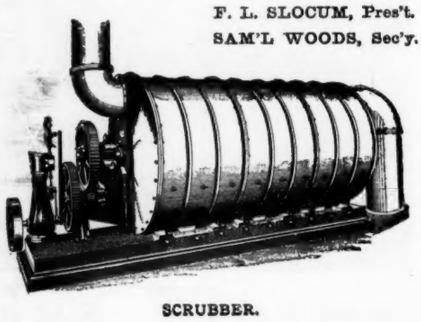

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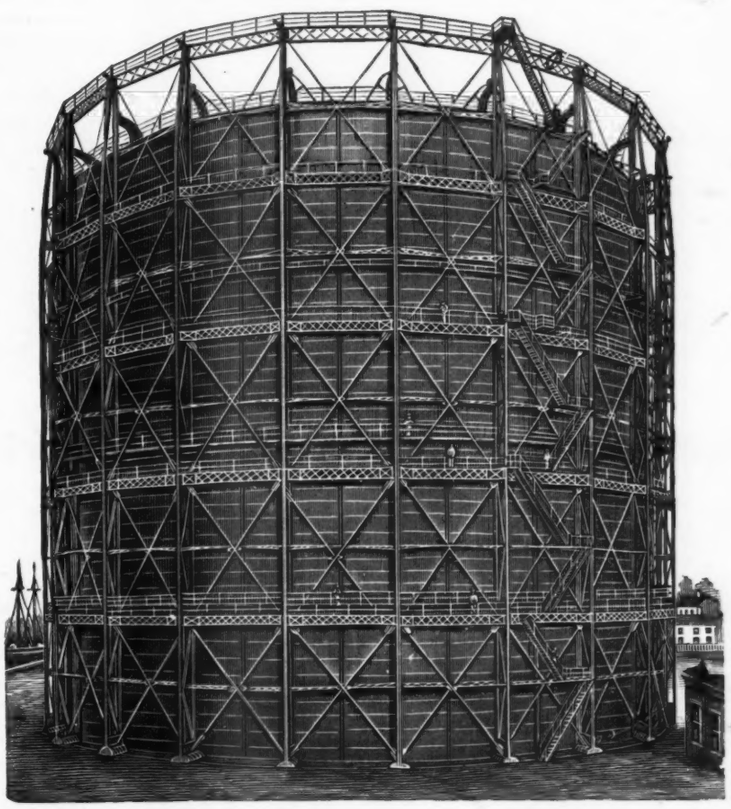

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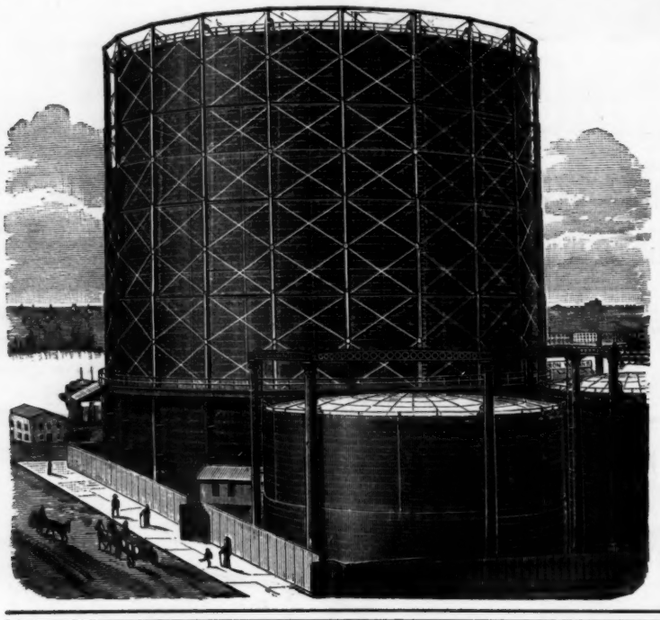

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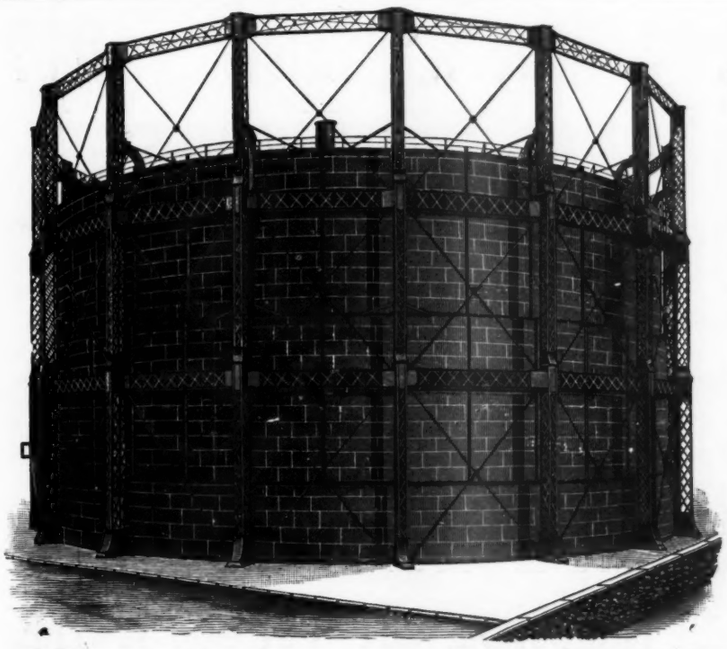

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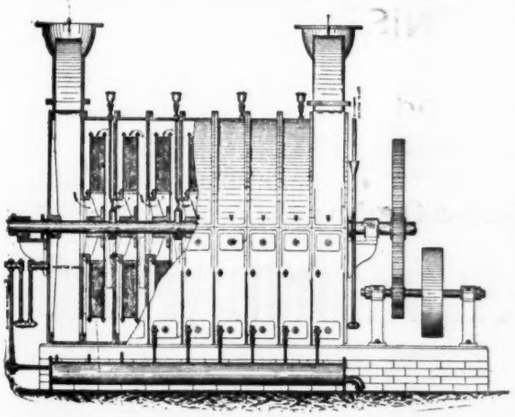

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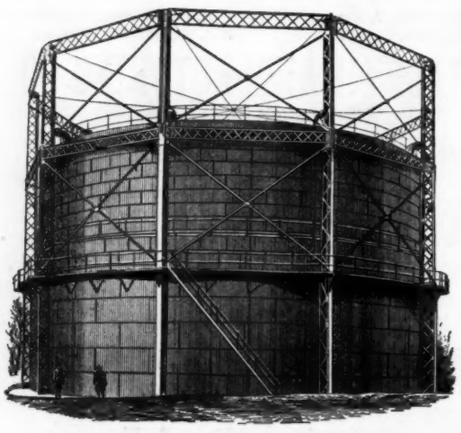

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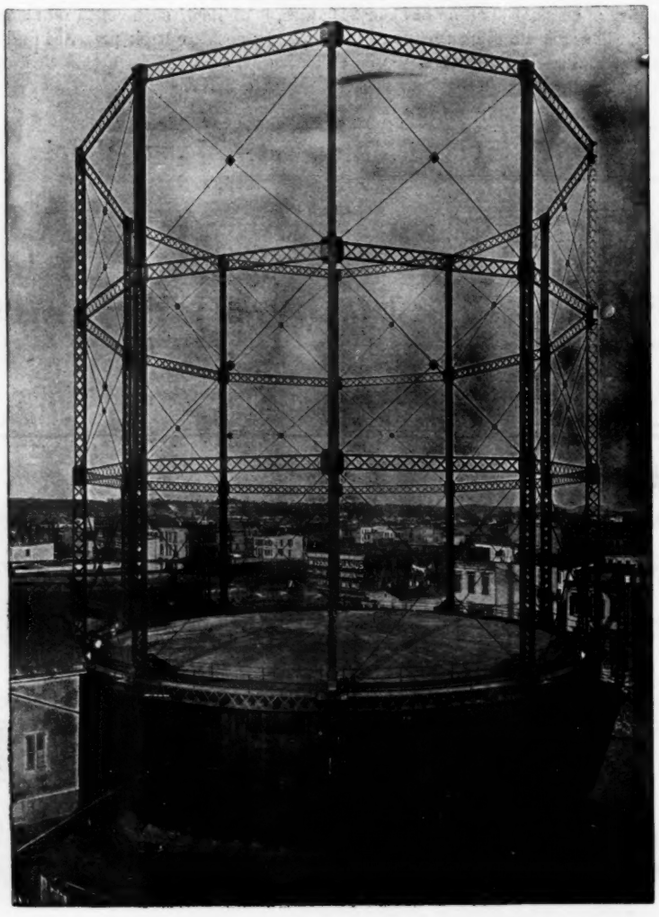

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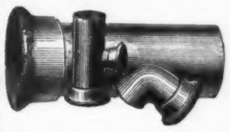

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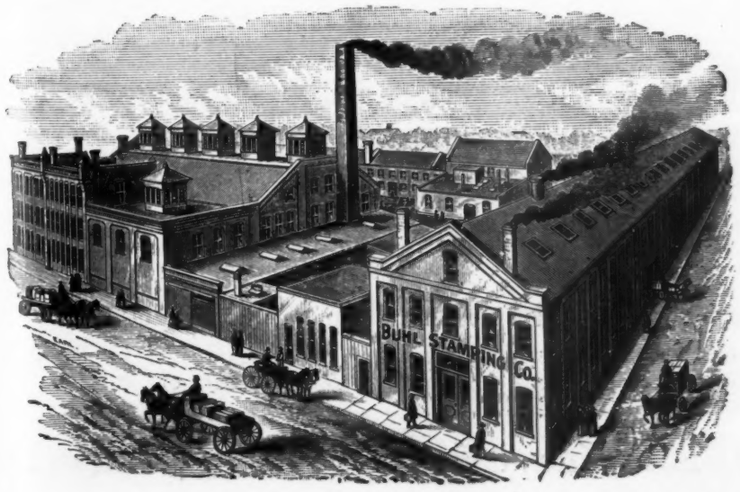

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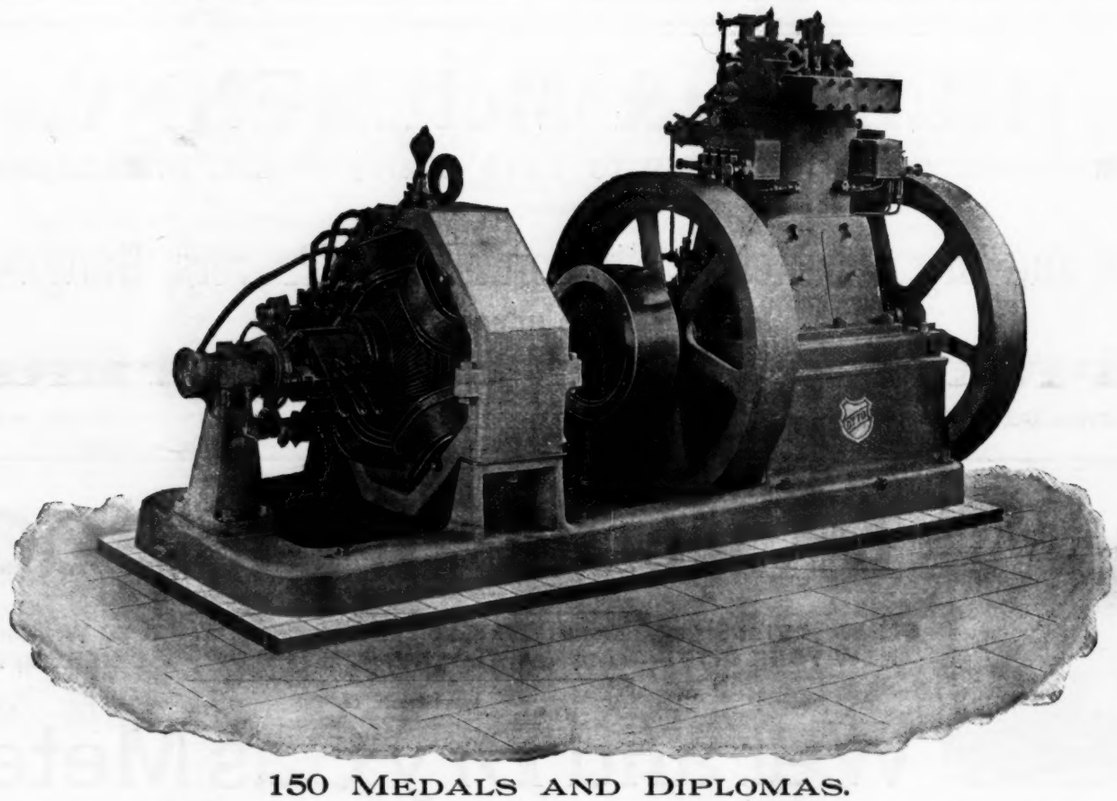

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